...unded in 1832

RAILWAY LOCOMOTIVES AND CARS

NOVEMBER 1953

...OR OFFICERS AND SUPERVISORS RESPONSIBLE FOR DESIGN, CONSTRUCTION AND MAINTENANCE OF MOTIVE POWER AND ROLLING STOCK

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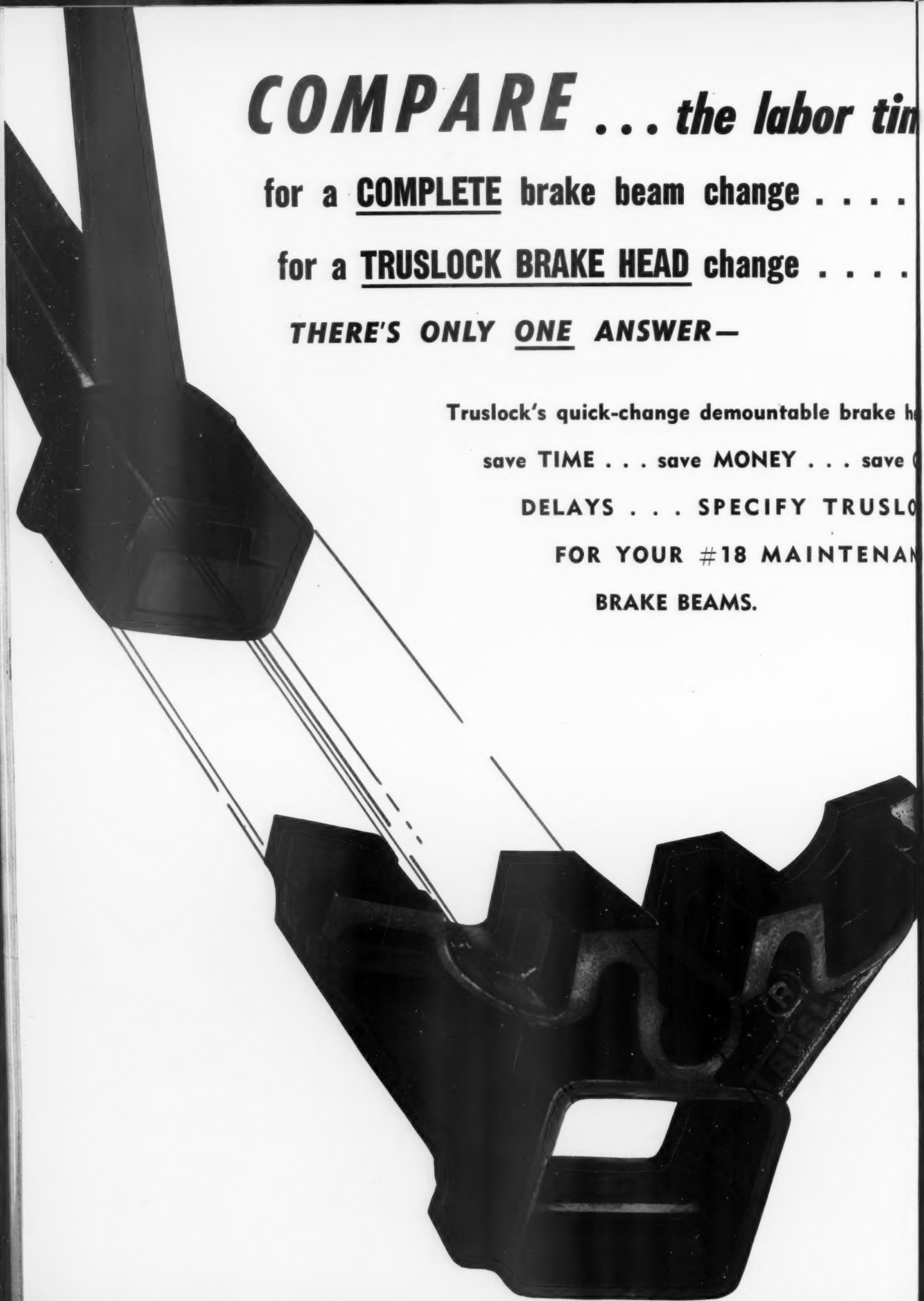

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on passenger-train cars

Longer Life: A recent analysis of all EDISON car-lighting batteries replaced by one railroad during a period of 12 months showed that the batteries had given an average of 26.18 years of service.

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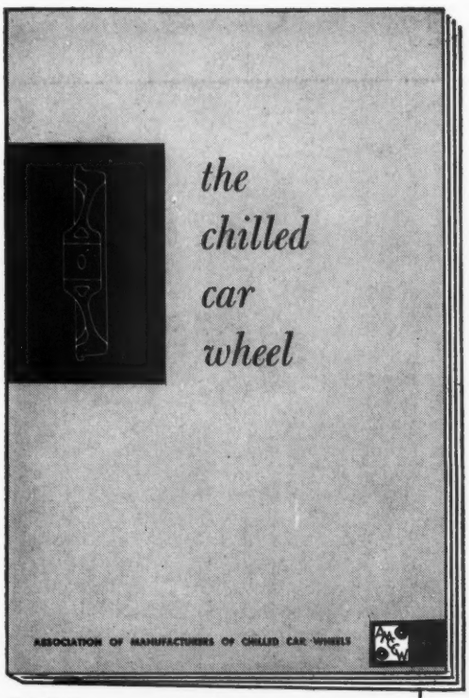

FREE—new booklet

What is chilled iron? How is it made?

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What type of wheel has the best overall safety record in freight car service?

These and dozens more questions about wheels for freight car service are answered in this 64-page booklet recently published by the AMCCW for distribution to those responsible for the purchase, inspection, mounting and maintenance of freight car wheels, and for apprentices who want this background information.

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This is the story of the wheel that carries two-thirds of the nation's freight cars...the chilled car wheel as it is made today in AMCCW plants —vastly improved over earlier designs, and with a safety performance that is second to none in this tough freight car service. This booklet packs a good deal of useful reference information into its 64 pages.

Main sections are devoted to chilled car wheel characteristics and properties, manufacturing operations, and inspection practices.

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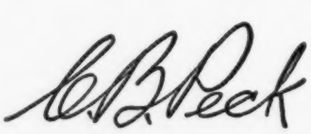
Teamwork

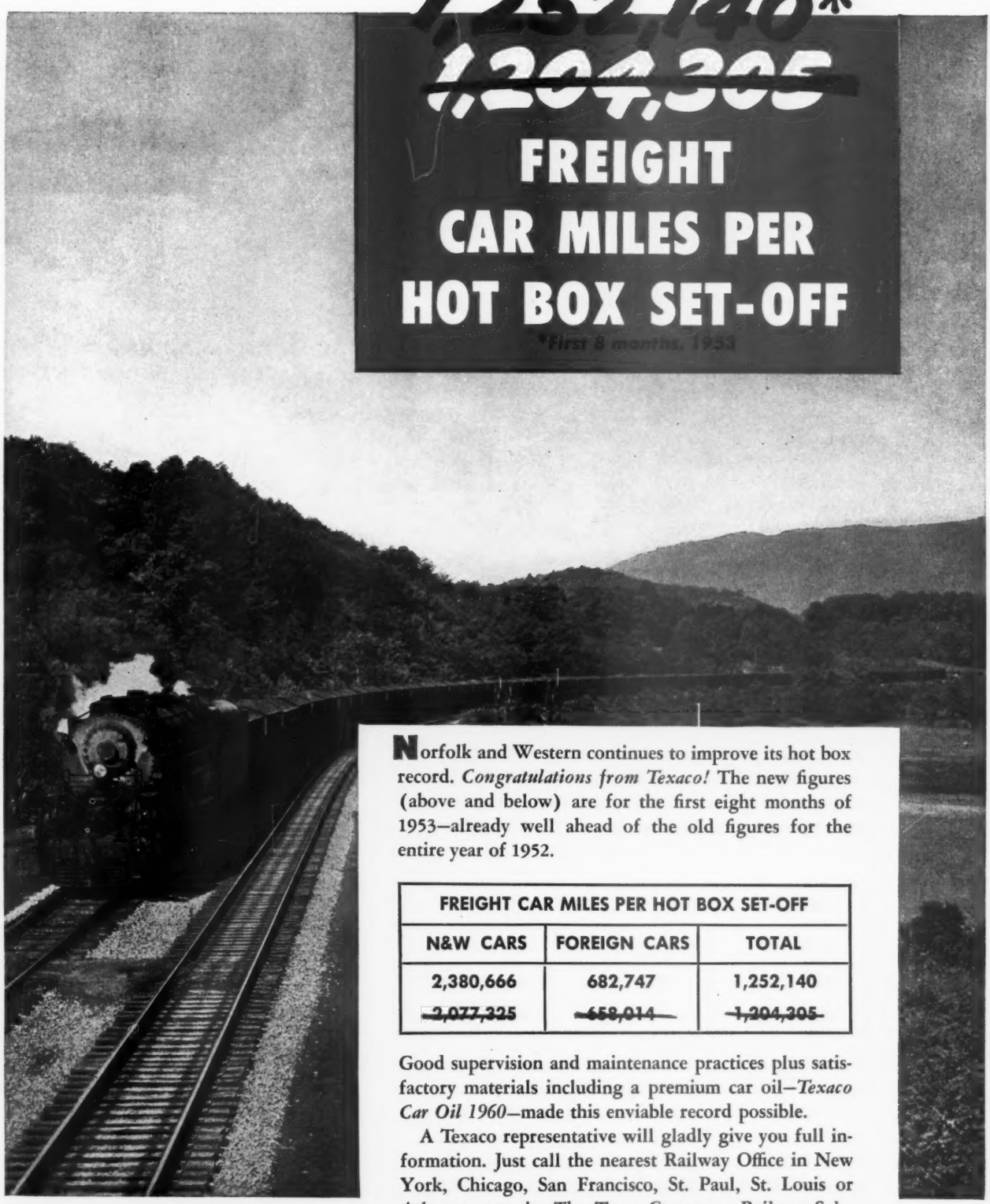
The success of the meetings of the Coordinated Mechanical Associations held at the Hotel Sherman, Chicago, September 14 to 16, is an indication of the solid place these organizations have acquired in the railway field. Some doubts were expressed before the meetings as to attendance after the large attendance at the Atlantic City meetings and exhibit and because of the absence of any exhibit at Chicago. As a matter of fact, attendance at all the meetings was satisfactory and, in general, larger than in 1952.

There have been times when railway managements were inclined to look askance at the participation of supervisors and the men in the ranks in the creation of a successful railway beyond the strict obedience to orders. A realization of the contribution which the talents and brain power of the men throughout the organization can make to the successful functioning of the railway business has been growing during recent years. Of course, the management must bear the ultimate responsibility and must shape its policies. But the truth that the strength of an organization in which teamwork is achieved is greater than the sum of the strengths of its individual members is being accepted more widely every day.

The problem of getting the utmost out of an organization in the way of teamwork without the sacrifice of essential discipline depends for its solution upon the supervisors who deal personally with the employees in the ranks. These are the men through whom the policies of the management are interpreted. Their opinions should be known before policies are adopted. Without their loyal support, the loyalty of the men in the ranks becomes doubtful.

These are some of the reasons why associations of supervisors, such as the Coordinated Mechanical Associations, are being accorded the recognition and encouragement which was so evident at the Chicago meetings.





Norfolk and Western continues to improve its hot box record. *Congratulations from Texaco!* The new figures (above and below) are for the first eight months of 1953—already well ahead of the old figures for the entire year of 1952.

FREIGHT CAR MILES PER HOT BOX SET-OFF		
N&W CARS	FOREIGN CARS	TOTAL
2,380,666	682,747	1,252,140
~~2,077,225~~	~~658,014~~	~~1,204,305~~

Good supervision and maintenance practices plus satisfactory materials including a premium car oil—*Texaco Car Oil 1960*—made this enviable record possible.

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IN ALL 48 STATES

EDITORIALS

Association Progress

The M.B.M.A's. Future

Many railroad men have asked, "What does the Master Boiler Makers' Association find to talk about in this day of the diesel?" It's a good question, one that the M.B.M.A. has had to answer since the end of World War II when the diesel started crowding the steam locomotive out of the motive power picture. An organization less resourceful under the same circumstances might easily, and gracefully too, have picked up its tools and called it a day but the master boilermakers set about finding out where their experience and talents could be used advantageously in serving the railroads in the diesel field. This year's M.B.M.A. annual meeting program at Chicago, reported elsewhere in this issue, was the answer to this problem and it will be an excellent guide to the association's work in the future.

Five of the six reports presented this year dealt with diesel maintenance. They included the welding of diesel parts, the maintenance of steam-generator coils, water treatment for cooling and steam-generator feedwater systems, water-tank design, and the washing and cleaning of air reservoirs. The master boilermakers are fitted by years of experience to discuss these subjects because welding, water treatment and the fabrication, cleaning and washing of pressure vessels and water tanks were important parts of their duties as boiler supervisors. In this work they excel.

The name "Master Boiler Makers" is no longer fully descriptive of the association's work and it undoubtedly leads uninformed railroad men to ask what the association does. The name is not important. The important point is that the Master Boiler Makers' Association will continue to serve the dieselized railroads with the same competence and as honestly as it has served the steam roads since 1902.

•

Discipline

A perennial problem of railway operation which is a matter of constant concern to all railway officers was stressed repeatedly in the addresses delivered before the Railway Fuel and Traveling Engineers' Association during its annual meeting. That is the observation of rules. Its importance was emphasized in connection with safety rules, operating rules, and signal rules. The members were repeatedly reminded of two things: that they, themselves, must never fail to live up to the rules if they expect men under their supervision to take rules seriously, and that they must never let a violation pass without calling it to the attention of the violator. Certainly, if the strict observance of rules is too arduous a task for a supervisor, what can be expected of the men in the ranks? And if the supervisor is conscious of serious shortcomings in his own observance, he is severely tempted to overlook violations by others under some circumstances rather than face the contempt his apparent insincerity engenders.

In the promotion of safety, employee relations, the prevention of rough handling, and good public relations—subjects dealt with in the addresses—the part which the road foreman plays is apparent. It did not need to be stressed to be clearly understood.

Road foremen, like all supervisors who deal directly with men in the ranks, exercise a large influence in determining the success of railway management. Management does well to recognize this and must take measures to keep these supervisors sold on its policies.

The close attention with which the Traveling Engineers' sessions followed the lecturers who dealt in detail with the operation of diesel locomotive electrial control circuits makes it evident that, in adapting themselves to operating diesel-electric locomotives, traveling engineers and the enginemen whose work they supervise are rapidly mastering the electrical aspects of the new motive power. In time, they will have as complete a practical knowledge of the electrical equipment with which they deal as they now have of the mechanical features of diesel locomotives.

•

More and Better Car Inspection

There is a growing sentiment among responsible car supervisors that freight cars must receive better attention and mechanical servicing in train yards if they are to operate satisfactorily in the present long high-speed runs between terminals. At the Car Department Officers' Association meeting, for example, an appeal was made for more effective cooperation between operating and car forces in transportation yards and especially the provision of enough car inspectors and trained supervision to do the big job assigned to these men in the generally

shorter time now available. One comment was to the effect that supervision needs more emphasis; that car foremen in most cases know what needs to be done, but not how to get it done with the men at their disposal; that too much responsibility is put on lead men before they are ready for it. As a matter of fact, experience shows that concentrated effort in almost any transportation yard *with adequate supervision* will produce results even to the extent of practically eliminating hot boxes.

In support of this statement, W. C. Baker, vice-president, operation and maintenance, B&O, said in addressing the association: "Successful operating efficiency requires uninterrupted freight-train schedules. To have uninterrupted freight train schedules there must be a plan in effect that must start with the calling of the train from the initial terminal, and a time figure for its arrival at the next division terminal and at destination. The car foreman and the yardmaster must cooperate with each other in planning the dispatchment of a train. Cars must be switched together in advance of the calling time of the locomotive and turned over to the car inspectors, giving them sufficient time to do their work so that when the road engine couples to the train the only additional time needed is for the terminal air-brake test, which must be made before its departure."

As evidence of what can be accomplished by cooperative effort in train yards, the B&O averaged only 372,732 miles per freight car failure on road, exclusive of hot boxes, in 1942 and raised this figure to 2,039,797 miles per failure in 1952 and 2,287,700 miles per failure in the first six months of 1953. In 1942, the number of miles per freight car set out on account of hot boxes was 276,-511, this figure being raised to 588,929 miles per hot box in 1952 and 755,835 miles per hot box in the first six months of 1953.

Passenger-car shop and coach-yard supervisors will find information of real value in the report on passenger-car maintenance which is quite comprehensive and contains some real information on cleaning materials and methods. Similarly, the sizeable group of painter foremen and supervisors responsible for this important phase of car maintenance who were in attendance proved quite vocal and made a real contribution to the meeting.

●

Assuring Future Skills

To get back to prewar standards when railway shop crafts were practically 100 per cent skilled mechanics who had served a full apprenticeship, we must stop upgrading helpers and establishing partially skilled men on the permanent journeyman's seniority list. The adoption of this policy, plus restoring to normal the apprentice ratio and increasing apprenticeships to five years, are essential if we are to have soundly and thoroughly trained mechanics for the future, contended L. B. George, assistant chief motive power and rolling stock of the Canadian Pacific in an address before the Air Brake Association.

The general subject of training was also chosen by J. V. Elsworth of the New York Air Brake Company for his talk before the Air Brake Association. He said that the basis for a good knowledge of airbrake equipment is a thorough understanding of the simple automatic air brake. Complicated equipment is best understood when simple types are taught first and the relationship between the two explained. The instructor, for his part, must possess a sense of humor, be patient and understanding in addition to knowing his subject well. He must teach his men to think analytically, as this is essential for diagnosing trouble.

Considerable interest was shown in a suggestion that air brake men have their own craft with a separate seniority list. There was general agreement on the desirability of this, and rightly so, because air brakes have reached a degree of complexity comparable to any other piece of equipment in railroad use today. Air brakes are the type of thing to which a man devotes his major efforts and becomes an expert at, or knows practically nothing about. Only the former man should be entrusted with the responsibility of maintaining equipment so vital to safe train operation.

●

"Nothing Succeeds Like Success"

Regardless of what anyone may think about the dangers of "bigness" almost anyone will admit that the growth of the Locomotive Maintenance Officers' Association from a small group of less than 100 in 1939 to a total of 3,850 in 1953 is at least an indication of its aggressiveness, of the value of its experimental approach to program building, and of the success with which it has met the needs of its field during the years when the diesel-electric was replacing steam power.

Once again, the association should be reminded that leadership imposes certain responsibilities and often exacts penalties. "That which is first is always in the white light of publicity" and, usually, "that which deserves to live, lives." So, regardless of how well satisfied any member of the association may be with its accomplishments, it is still a long way short of the goals it really could and must reach if it is to continue to serve its membership as it should.

As one mechanical officer pointed out, it is almost impossible for any one railroad to send more than 10 or 15 per cent of its mechanical staff to the annual meetings and still run the railroad. So, on most roads, the only contact that the majority of mechanical and electrical people have with the association in any one year is what the 10 per cent bring back in the way of valuable information and enthusiasm which they can impart to the rest of the staff, and the record in the annual proceedings. Too often an organization thinks primarily of those that come to its meetings, but the real need is to put into its programs the material that inspires all supervisors and employees continually to look for better ways to do their jobs, ways in which they can fit themselves for bigger and better jobs and broaden the scope of its committee activities to a point where each report is really comprehensive and represents a cross-section of the experience of a great number of railroads, not just one or two.

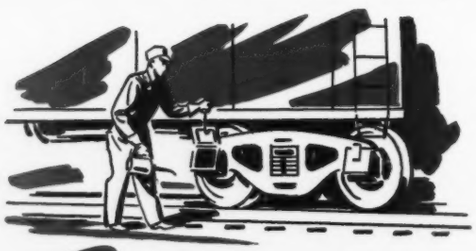
The L.M.O.A. is to be congratulated on its success, but continually reminded of its responsibilities to the industry. That's one of the penalties of "bigness."

Some interesting *facts* about

FREIGHT CAR SERVICING

and

LOW-COST SOLID BEARINGS



How much time is given to train inspections . . . to what extent journal bearings are involved . . . what the present cost is—in man-hours and materials . . . and how better maintenance and available developments can further improve efficiency

FREIGHT CARS spend about 9 hours a day in yard movements—interchange between roads, classification, and switching to loading and unloading tracks. But according to reliable information the average train is held only 30 minutes or less for car servicing and inspection. *That's less than 6% of the yard moving time—and far less of the total time in movement or subject to movement.*

You couldn't eliminate this inspection—even if bearings were no concern at all. It includes too much other equipment—brake hoses and rigging, wheels, couplers, air valves, door seals, and many other items in addition to journal bearings. It takes an appreciable amount of time just to walk the cut of cars. So even though it takes some man-hours to inspect the bearings, chances are in the vast majority of cases this bearing inspection affects departure times scarcely at all . . . certainly hardly any more than would be the case with any other type of bearing.

What do these man-hours cost? Well, based on the number of packers and oilers required by one railroad, whose miles per hot box for 1952 was 3 times better than the national average, the annual cost per car owned for this labor is only about 3% of the cost of installing expensive non-standard bearings. That includes the labor for repacks, too. In fact, total cost per car owned per year for all labor *and materials* needed for routine solid bearing maintenance comes to less than the annual interest and depreciation on the huge investment necessary for non-standard bearings. So, when you take the high costs of periodic disassembly and inspection of non-standard bearings into consideration, it's obvious that solid bearings are by far the better buy.

How to Lick Hot Boxes and Cut Inspection Time

You can lick hot boxes best with low-cost solid bearing designs. Here are just three available improvements—each designed to increase bearing mileage and each adaptable to existing equipment:

1. ***Low-cost heat resistant Satco lining metal***—Has a melting point 150° higher than standard babbitt, particularly advantageous in summer, but helpful all year round, too.

2. ***Twinplex Alarm Bearings***—Give smoke and odor indications should abnormal temperatures be reached, help detect failures before they become serious.

3. ***Magnus R-S Journal Stops and Packing Retainers***—Eliminate excessive axle displacement that causes waste grabs and spread linings. Keep the packing in place too—cut down man-hours for journal box servicing.

Combine these improvements with a program to upgrade maintenance standards and hot boxes will virtually disappear. And, of course, then you still retain all the inherent advantages of low-cost solid bearings.

Be sure to get your free copy of the "FACTS." Just write to Magnus Metal Corporation, 111 Broadway, New York 6; or 80 E. Jackson Blvd., Chicago 4.

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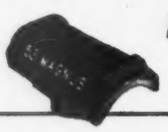
Solid Bearings



Right for Railroads
. . . in performance . . . in cost

MAGNUS METAL CORPORATION *Subsidiary of* **NATIONAL LEAD COMPANY**

Car Men Discuss Fundamentals

Annual CDOA meeting at Chicago develops pertinent facts on train yard inspection, interchange and loading rules, lubrication, car repairs and painting

At one of the best attended annual meetings held in recent years, the Car Department Officers' Association got down to "brass tacks" on the first day of its convention at Chicago, September 14, and kept hammering away at the major problems confronting car men.

The addresses were on the following subjects: "Car Department Responsibility for Successful Train Operation," by W. C. Baker, vice-president, operation and maintenance, B&O; "Human Relations," by F. J. Goebel, vice-president, personnel, B&O; "Safety," by F. R. Callahan, director, Bureau of Safety and Compensation, Pullman Company; and a prepared discussion on "Lubrication," by W. M. Keller, director of Mechanical Research, Association of American Railroads.

Formal committee reports were presented on the following subjects: Analysis of Train Yard Operation, presented by Chairman C. E. Dyer, terminal supervisor of car maintenance, C&NW; Interchange and Billing for Car Repairs, by Chairman C. W. Kimball, supervisor of car inspection, Southern A.A.R. Loading Rules, by Chairman A. H. Petersen, superintendent car department, Belt Ry. of Chicago; Wheel Shop Practices, by Chairman E. W. Kline, general wheel shop foreman, B&O; Car Lubrication, by Chairman H. J. Baker, superintendent car department, Pere Marquette District, C&O; Expeditious Handling of Light Repair Cars, by A. J. Larrick, regional master car builder, B&O; Air Conditioning Equipment by C. Manzelman, air-conditioning and electrical foreman, Milwaukee; Maintenance of Passenger Cars, by J. F. Swafford, assistant master mechanic, Washington Terminal Company, Maintenance Painting of Railway Equipment, by F. M. Vogel, painter foreman, D&RGW.

F. H. Stremmel, Sec.-Treas.

A. H. Keys, President

Cooperation in the Coal Yard

By W. C. Baker

Vice-President, Operation and Maintenance, B&O

"Successful operating efficiency requires uninterrupted freight train schedules. To have uninterrupted freight train schedules there must be a plan in effect that must start with the calling of the train from the initial terminal, and a time figure for its arrival at the next division terminal and at destination. The car foreman and the yardmaster must cooperate with each other in planning the dispatchment of a train. Cars must be switched together in advance of the calling time of the locomotive and turned over to the car inspectors, giving them sufficient time to do their work so that when the road engine couples to the train the only additional time needed is for the terminal air brake test, which must be made before its departure. . . .

"Careful study of this problem on the B&O a number of years ago established, beyond a question of a doubt, that there was room for more cooperation between the yardmaster and the car foreman. Proper effort was apparently not made by the yardmaster to build up trains or switch together groups of cars for the train, with the realization that after the switching was completed the car inspectors had their duties to perform. The result was the trains were not completed until scheduled departure, and seldom re-

received any servicing other than the terminal air brake test which is required by law.

"The car foreman did little or nothing about it, for had he held the train to service the journal boxes or correct defects which might have resulted in brake beam failures, excessive slack action and subsequent break-in-twos on the road, he was fearful of being charged with the delay to the train. When the yardmaster and the car foreman work out their problems jointly in a spirit of cooperation, trains can be made up, receive proper inspection, repairs and journal box attention and depart from the initial terminal on schedule.

"To indicate what this cooperation on the B&O has accomplished during the last ten years, the following figures are significant.

"The 1942 freight car failures on the line of road, caused by coupler defects, trains parting, air brake conditions and brake beams coming down, resulted in an average of 372,732 miles per freight car failure. In 1952 the miles per car failure were 2,039,797, while for the first 6 months of 1953 the average was 2,287,700. These failures do not include the number of cars set off on line of road, between division terminals, for hot boxes.

"In 1942 the B&O averaged 276,511 miles per car set off on account of hot boxes. In 1952 we obtained 588,929 miles per hot box, and for the first six months of 1953, 755,835 miles per hot box. This improvement was accomplished even though the average speed of all B&O freight trains (Q.D., tonnage, locals, mine district runs) increased about 13 per cent in this same period."

Analysis of Train Yard Operations

Due to extensive competition, the railroads have found it necessary to speed up operations. It is necessary that the mechanical department take extra precautions to see that equipment is placed in proper condition to meet the situation. This calls for a departure from some past practices. The trend on most railroads is to place more hump yards in operation and to run greater distances without terminal inspection. Many railroads now run distances of 500 miles and it is common practice to go 300 miles without terminal inspection. At points in between these long runs, a "rolling" or "dragging" inspection is given; to do this, car inspectors are stationed at the receiving switch and the trains are pulled by them at about four miles per hour. It is easily understood why we must re-examine inspection practices at the main or originating terminals.

All empty cars must be given a thorough inspection at the distributing terminals and journal boxes and appurtenances properly examined with journal box packing adjusted and oiled. Cleaning tracks are an excellent place to do this work and other locations that can be utilized are industry tracks and team tracks. Many roads have placed carmen, oilers, etc., at freight houses, team tracks, and industry locations so that when cars are loaded they can be moved direct or quickly through train yard with a minimum of attention, therefore, speeding up operations.

Work Needed at Repair Tracks

Repair track inspection must be thorough as all cars get to the repair track once in a while and we should use this opportunity to properly inspect cars for defects and correct them. In addition, test and adjust air brakes as well as giving proper attention to journal boxes.

More attention must be given to proper roof inspection as with the advent of steel running boards, car inspectors are prone to take roof inspection for granted. As we yet have many cars with wooden running boards, etc., is is essential that proper inspection and care be given them, and of course, metal running boards and brake steps should also be properly inspected and cared for.

As the speed of freight trains is being increased, it is now more than ever necessary that air brakes be properly maintained. To do this, main train yards, repair tracks, etc., should be equipped with yard testing plants of proper installation so that air brakes can be tested out and adjusted in advance of road engine being placed on train, to avoid delay. It is also essential that leakage be reduced to the minimum.

Trucks and Doors Need Attention

When empty cars are conditioned or when they are moving on the line or standing in terminals, their side doors should be kept closed to avoid rain, snow, etc., getting into them and in addition to avoid damage to doors in switching movements, slack action, etc.

We must continue to make careful inspection of trucks, brake rigging, etc. Many derailments are being caused by brake beams coming down and broken truck sides. This inspection is very important and inspectors should be cautioned continually on this feature of their inspection.

To reduce time in terminals some roads are eliminating inbound inspection and making outbound inspection only. This, of course, reduces terminal delay, but a number of members are of the opinion that this type of operation requires further study.

What To Do With Packing Retainers

Many of the roads now have made standard the application of packing retainers to their owned cars. While this application is meritorious, it also creates a problem as car inspectors cannot adjust packing with the retainers in place. It is the general practice to pass up these journal boxes without attention, when actually after running a few months with retainer in place, the waste will settle away from the journal and retainer must be removed and packing reset. This is a feature that will require constant supervision and whenever possible on repair tracks—cleaning tracks—industry tracks, the packing retainers should be removed, packing set up and the retainer re-applied.

Consideration should be given by the railroads to increased supervision in train yards in the mechanical department due to the number of inexperienced employees being injected into the service and the speeding up of operations due to diesel power, long trains, etc.

To assist the supervision and bring about better hot box performance we recommend that a craftsman or car inspector be specially trained to act as lubrication inspector and teach new employees as well as others proper method of servicing journal boxes as outlined in A.A.R. Lubrication Manual and individual railroad instructions. This employee to act as a free lance on their respective shifts for lubrication purposes only, working as a mechanic under supervisor in charge. Further, whenever possible, new employees to be placed in the train yards as oilers first be worked on the repair track and given an opportunity to work on cars that are being handled under rule 66.

The report was presented by a committee of which C. E. Dyer, terminal supervisor car maintenance, C&NW, was chairman.

Report of Committee on Painting

In using hot spray paint on new steel freight cars, it is desirable to obtain paints which have been tailored to the purpose. For instance, in air-dried paint, the mixture is approximately 40 per cent solids and 60 per cent solvents. Hot paint should be made in the reverse ratio—approximately 60 per cent solids and 40 per cent solvents—heat only supplying the necessary thinning agent.

There are several benefits obtained by the use of hot paint entirely aside from the savings effected. One of these is that the effects of excess humidity, which show up in crawling, alligatoring, etc., are entirely eliminated. Also, the resulting dried coat of paint is much more elastic, the gloss remains for a much longer period of time so that chalking does not take place until years after it has taken place on cars painted with conventional type paint. Information received on cars having a coat of hot paint that were struck, shows that the paint does not shatter, with the resulting benefit derived from rust not setting in from such accidents.

The painting of cars with hot paint has been made possible by the present availability of heaters, which are inexpensive and portable, thereby eliminating the need of pumps and extra hose for the re-circulation of the hot paint. These heaters can be placed on a small carriage which rolls along with the operator, or are carried in an insulated bag, with the use of a shoulder strap, by the painter. They are light; a single unit, carried by the painter, would weigh about six pounds, and the double unit, which would roll along, would weigh about 20 lb. With these units, short lengths of hose from the heater to the spray guns, that is, 6 ft. to 12 ft. in length, are adequate, and eliminate the necessity for re-circulating the hot paint. These units have ther-

mostats with which the heat can be set at from 150 deg. to 200 deg. F., and with the short length of hose, there is only a drop of about 10 deg. at the gun.

Savings in Labor and Material

The savings in labor result from the fact that a coat of hot paint is equal to two full coats of conventional type paint and can be sprayed easily in cross coats, thereby eliminating the need for waiting time and labor necessary to apply a second coat. In the committee's experience, coats up to 2 mils dry film have been applied without sagging or runs, in one pass. The savings in material stems from the fact that the paint going on the cars is a high solids paint and does not have the excess amount of solvents to flash off into the air. Also, there is considerably less over-spray for the same reason.

Figures available from one of the latest and most modern paint shops, painting 40 ft. box cars, are, in percentage, as follows: Savings in material 10 per cent, labor saving 15 per cent, and maintenance saving (power, air and hose, including cost of and maintenance of heaters) 20 per cent. Remember this covers only this particular shop's condition.

While the foregoing report on the application of hot spray covers freight cars exclusively and indicates the excellent results which can be obtained on freight cars, there is some question of its adaptability to passenger cars. Tests have been made of the application of hot enamel on both the exterior and interior of passenger cars, and the results have not been satisfactory.

We understand that these tests (on passenger cars) were made with conventional type enamels or lacquers and a re-circulating type of heater, using long lengths of hose. Perhaps if these tests were repeated, using high solids materials tailored to the requirements (as has been done in many other industrial applications), using portable types of heaters where the heater is close to the gun, it would be found that the application of heated materials to passenger cars might be very successful.

Further tests along these lines seem to be indicated.

Passenger Car Wall Covering

During the last few years, many types of wall coverings have been used for wall protection and decorative appearance. Of these several kinds used, some have been partially successful, while others have met with failure. More recent ones show promise.

Cloth-back veneer, used in some types of cars, has an attractive appearance but has proved costly because of cracking, peeling, and loosening at the joints, which makes it hard for a partial repair job, and most of the time the covering has to be completely renewed.

A transfer which closely resembles any wood grain can be used where a harder surface is desired.

A vinyl wall covering, which is a transparent sheet of vinyl resin, with a thin coating of pigment fused to the back side for coloring, has been tried by several railroads without success. This type of covering is susceptible to discoloring of the pigment by the adhesive or other foreign matters. It also has a tendency to yellow with age. This unsupported vinyl sheet has a tendency to shrink and pull open at the joints thus resulting in an unsatisfactory appearance. There are, however, additional vinyl types in which the manufacturers are doing a considerable amount of research.

There are also available materials which closely match veneer, and which may be substituted where veneers are now used, or desired. These have a much harder surface than vinyl, unsupported or unlaminated, and are made from layers of especially processed papers, impregnated with synthetic resins. In special cases, where it is desired to substitute for paint color scheme, we recommend these newer products having plastic surfaces, and which are available in almost any color.

After wall coverings of this type are applied, instructions should be issued that, at no time, should paint be applied to these decorative materials, as the decorative appearance is destroyed by the application of paint. There is definitely a need for a suitable wall covering for the interior of passenger cars for quick maintenance, resistance to scuffing from shoes and luggage, durability, and decorative effects.

A wall covering should have the following qualities: (1) Exceptional scuff resistance; (2) ease of cleaning, including removal of luggage marks; (3) resistance to very strong cleaning solutions; (4) retention of the original color without fading or turning colors; (5) free of shrinkage; (6) cementing qualities, along with the proper adhesive for the given job.

The particular problem is getting an adhesive that will hold and cure properly between two non-porous surfaces, such as a vinyl sheet and a metal surface.

Automatic vs. Manual Painting

Among recent developments in painting methods are the automatic spray painting machines for freight cars. Similar machines have been used for years in many production plants for finishing a variety of products. They will automatically paint box cars, gondolas, or hopper cars, with either hot or cold paint, with a saving of paint, labor and time.

A small part (about 1½ per cent) of the surface of smooth sided box cars must be touched up by hand spray. The automatic spray will not completely cover such protected surfaces as back of ladders, door tracks, door handles, and under sides of sills. Some box cars and some gondolas and hopper cars require more hand spray touch-up than others. Since some paint is applied to these surfaces by the machine, it is only necessary to touch up after one coat. This may be after the first or second coat, as desired, while the machine is painting the rest of the car. This is not recommended on single sheet freight cars.

These machines are available in two types. One is stationary, having the car pulled through the spray booth containing the automatic machines. This type is preferred where cars are moved one at a time, such as for prime coat after sand blasting. The other type is mounted in a portable spray booth that moves along a line of cars to be painted. This type is preferred for the finish coats on several cars in rapid succession.

The machines are designed so that the spray starts and stops at the edge of the surface to be painted to avoid waste of paint, and they are adaptable to cars of different heights and widths. They may be had with automatic units for sides only, where tops and ends are not to be painted with the same paint as the sides, or with automatic units for sides and roof, if desired. Since the men doing the hand spray touch-up can just as well paint the ends, it was not considered economical to provide automatic units for this purpose; however, automatic units can be made that will paint either one end of one car in a line, or two ends where two or more cars are coupled together.

In the application of hot paint, the machine has the advantage over hand spray method because shorter lengths of hose are required. The longer lengths of hose required for hand spray necessitate higher temperatures at the heater. The automatic machine requires only about twelve feet of hose.

Savings in material could be safely estimated to be 25 per cent; savings in labor, approximately 35 per cent. It is estimated that the savings in material, labor, and equipment would be greater when using high solids paints, since one application would take the place of two.

The report was presented by a committee of which F. W. Vogel, painter foreman, D&RGW, was chairman.

Report on Passenger Car Maintenance

A scheduled shopping should be set up for cars in assigned service. By so doing, equipment can be progressively maintained in the best possible condition, and in assigned service, the limits can be set for wheel changes for tread wear. This can be determined by the particular service cars are operating in, and by this type of control, economies can be reached by changing all wheels on a car at the same time. All other necessary work should be accomplished at the time of wheel changing. This method will keep cars in service for longer periods, and has proven to be a success where a program of this kind is in effect. In this same program, it has been found on regular wheel changes that less complaint of rough riding is received.

The time limit set is reached by estimating or determining the actual mileage the cars will make on the particular assignment. In any service that cars are regularly assigned to, a program can be set up, and time limits can be set by watching the wear on cars in any one service where the tread wear will be governed by the particular rail conditions—or any other conditions that might affect tread wear. Some roads have found it necessary to change

wheels on mileage as low as 70,000 miles, while other roads have found they can run the wheels as far as 160,000 miles; however, the figure set should be for all wheels to be changed at the same time, to save labor and avoid the unnecessary frequent shopping to change one pair of wheels individually. This will reduce the number of times a car may be out of service, plus also reducing the possibility of a car losing its assigned run.

Proper Truck Springing

The importance of proper springing arrangement cannot be overlooked, and great care should be exercised to know that proper spring arrangement is maintained. Otherwise, unsatisfactory riding will surely result. Exact adjustment should be made when body heights are being raised, to assure level trucks. Standard air, signal, steam and air pipe arrangement should be carefully checked to know that there is no departure from standards, thus avoiding en route difficulties which result from improperly located steam or air lines. A careful examination of air brakes should be made with single car testing device in strict compliance with the standard code of tests. At this time, brake adjustments should be made to assure a full active slack adjuster, thus avoiding brake adjustments in coach yard.

We cannot stress too strongly the importance of full information being available to all shop track personnel on all phases of passenger car standards, recommended practice and procedure for progressive plus thorough compliance with car construction specifications. When on the shop track where we find the forces following the procedures and practices set out by the personnel, we can depend on satisfactory results.

Periodic examination of journal bearings and repacking of boxes is a job that requires constant observation to assure good workmanship. This work should be done under well qualified supervision who will insist on full compliance with the instructions covering this work. The shop track is the best place for this work because all truck conditions such as box wear and pedestal liners causing excessive lateral of boxes in pedestals can be readily discovered and remedied. Also, bolster clearance should be checked for neat clearance to avoid undue shock on boxes, which in turn, would be transferred to bearings. Trucks should be carefully checked to make sure of level for proper distribution of weight on journals.

Daily and Extra Cleaning

Many feature trains contain such modern improvements as venetian blinds, draperies, portieres and paintings which, if neglected, will detract from the general appearance of modern trains. A program of maintenance should be arranged for, whereby necessary attention is administered periodically. Cars where cooking and smoking are permitted may require more frequent cleaning, while other cars should require attention only every two or three months. Cars requiring a general cleaning should first be fumigated.

Fumigation—In order to get maximum penetration, every closet or locker should be left open, and all refuse removed from the car. Both electric and compressed air fumigating machines have been found effective. This treatment should be repeated as often as it is found necessary.

Blowing—Before any interior cleaning is begun, all loose dirt and dust should be removed from the car. This may be accomplished by blowing or using a large vacuum machine aided by compressed air. The upholstery, if not removed from the car, should be carefully covered, and shroud disconnected from the evaporator. All air ducts, lockers and washrooms, etc., should be left open to present the opportunity of removing any accumulation of dirt. Air ducts should be blown in every direction several times before wiping. While car is being blown, every possible opening should be made for the escape of dirt—end doors and several windows should be left open for ventilation. Exhaust fans give considerable assistance in this work. At this time, the evaporator should be blown and steamed, and a strong cleaning agent used in the washing. Careful inspection should be made after blowing is complete, and before ducts are closed.

Washing—In washing the interior of a car, any solution that will damage the finish should certainly be avoided. There are cleaning agents that are most effective and which even appear to add to the luster of the finish. If application of the cleaner is followed with a sponge and wiping cloth, we are assured of an unstreaked and clean surface. Neither soap nor cleaner should ever be allowed to dry on walls. Saddle soap is recommended for the washing of leather, and a mild soap with a minimum amount of moisture is excellent for the brightening of paintings and murals. The manufacturers of tiling recommend their own cleaner.

After complete washing of the interior, upholstery and rugs should be brightened with a shampoo. There are 32 and 110-volt shampooing and vacuuming machines available which do an efficient job, and help considerably in expediting this work. Excellent results have been obtained by training employees for this particular type of work.

When possible to keep a regularly assigned force on this class of work, a savings in cleaning costs, as well as an improvement in quality of work is obtained, which no doubt is a result of the combination of pride in work and work efficiency.

The report was presented by a committee of which J. F. Swafford, assistant master mechanic, Washington Terminal was chairman.

Interchange and Billing for Car Repairs

During the past year your committee has considered proposed revision of and additions to the present Code of A.A.R. Interchange Rules, and we submit the following recommendations for your consideration:

Rule No. 9—Delete the last paragraph opposite caption "Wheels and Axles."

Reason: Wheels would not be removed or condemned by the reduced dimensions unless actually worn to the specified limits of wear and the reason for which car is shopped serves no purpose, but does require additional unnecessary writing on repair card.

Rule No. 9—Proposed Form: Note. Brake beams repaired and tested in accordance with these specifications must be identified with a dash of white paint on the fulcrum between the lever slot and compression member *and in the case of certified brake beams by marking with a steel stamp the letter "R" ½ in. high following the certificate number.* For A.A.R. Standard No. 18 brake beams, show "No. 18" and Certificate of Approval number, both of which are cast or marked on strut.

Reason: To comply with requirements of Manual of Standard and Recommended Practice, Sec. E, page 98, covering "Specifications for repairs to certified brake equipment brake beams."

Rule No. 17—In Paragraph (e), Note 3, 4th Paragraph, eliminate *50 per cent* credit for castings removed if in serviceable condition.

Reason: The truss rod beam is fast disappearing from car equipment and therefore is severely restricting opportunity for reuse. Most, if not all of them, are being disposed of as scrap and it is inequitable for repairing line to allow 50 per cent credit.

Rule No. 23—In Figs. 11, 12 and 13 change the knuckle hub gage, now shown as No. 25081 to No. 34411.

Reason: To conform with revised gage No. 34411, as shown in Manual of Standard and Recommended Practice, Page C-72-1952.

Rule No. 58—Proposed Form: Missing brake cylinders, reservoirs, triple valves, pressure-retaining valves, *release control retainer (with or without bracket and strainer)*, release valves, cut-out cocks, angle cocks or air hose, each or all complete.

Reason: So as to include the latest type valve, and coincide with Docket AC—3466 issued November 8, 1946, wherein it states the principle of Inter. 2, Rule 58, applies.

Rule 61—Proposed New Form: Par. (d) When car is on repair track, brakes must be tested as outlined in Par. 101 of the Maintenance of Brake and Train Air Signal Equipment. Piston travel found in excess of 9 in. must be adjusted to 7 in. or as near as practical thereto. Labor for adjusting will be on a connection pin basis. No charge permissible for testing.

Reason: Requirements at present place a heavy burden on railroads, some of which should be assumed by car owner. Long piston travel is as important a safety appliance defect as a bent grab iron and should receive the same encouragement in correcting same.

Rule 84, Inter. 2—Proposed New Form: (2) Q.—Who is responsible for damage to axle caused by packing retainer devices coming in contact with journal. A.—If a journal is found damaged by coming in contact with packing retainer devices, where standard to car and so stenciled, and there is no evidence of heating, car

owner is responsible, providing bill for repairs is accompanied by joint inspection certificate showing this information and executed as outlined in Rule 12.

Reason: It is unfair for handling line to bear burden for expense of replacing damaged axle caused by packing retainer devices.

Rule 86—Dimension "W" shown on cut of axle and table of dimensions, referring to center of axle, be changed to "K." Also, that similar change be made in figures 108-C and 108-D of wheel and axle manual.

Reason: So as to have axle center reference "letter" shown in Interchange Rule Book and Wheel and Axle Manual the same on all axle cuts.

Rule 94—In the center of the first paragraph, insert the word "wheels" after "side bearings."

Reason: If improper substitution of wheels, i.e., cast iron in place of M-W or 1-W wrot steel, is not corrected within one year from date of such wrong applications, a counterbill for correcting same should be prohibited.

Rule 101—Credit allowed for defective friction draft gears, as outlined in Rule 101 (Page 216) be reconsidered for downward revision.

Reason: The allowances of 55 per cent of new value for a defective approved gear, and 35 per cent of new value for a defective non-approved gear, when removed, are proving too liberal in actual practice.

Rule 107—Proposed Form of new note following Item 15: Note. —When two hangerless type brake beams are removed at same end of car, charge actual time, not to exceed 2.6 hours, plus jacking.

Reason: Labor charge for one hangerless type brake beam is limited to 2.4 hours, plus jacking, which is the present labor charge for R. & R. or R. of one truck side. Present note following item 15 of Rule 107 limits labor charge for hangerless beam to 0.2 hour when truck sides are R. & R. or R. and since truck sides are already R. & R. for the first beam, labor for second beam should be confined to additional 0.2 hour.

The report was presented by a committee of which C. W. Kimball, supervisor of car inspection, Southern, was chairman.

Car Lubrication

In summer, hot boxes are caused by lack of lubrication due to the oil settling in bottom of the journal box, leaving the top of packing dry. We sincerely believe that the railroads and oil companies can and will get together and decide upon an oil that will remain in suspension during the hot summer months and stand up satisfactorily in the cold winter months. We also believe that a better grade of waste must be used.

All technical problems, such as quality of waste, oil, tolerances in truck sides, journal boxes, bolsters, rear dust guard seals, redesign of wedges, journal bearings, etc., should be studied and developed by qualified personnel who are trained for this work. For example many journal bearings are removed because of loose lining, and improvement in bond between lining and journal bearing back and change in specifications, should be considered by the A.A.R. Lubrication Committee.

Also a rolled finish to the inside collar of axle in new and reconditioned journals should be made mandatory. The rim of the front face of all journal boxes should be smooth, the face of the hinge lugs equipped with wear plates and the hinge pin holes equipped with bushings. When cars are on repair tracks for repacking, wear plates must be examined and where found to be worn, should be replaced, either through the means of similar plates or by complete lugs equipped with wear plates; car owners to be billed for such service.

Your committee suggests that all devices used in journal boxes that are tested and subsequently approved as standard, or alternate standard, by the A.A.R. Lubrication Committee, should be of such design as not to slow up inspection and servicing of journal boxes at interchange and intermediate points.

A vast change has been made in operating conditions by diesel operation, not only in regard to higher speed out of terminals and between stations, but the limited time to service trains at stipulated terminals. More time must be allowed to properly inspect cars in trains, service boxes, or additional forces must be employed.

The work done by car department employees in train yards is of utmost importance and cannot be over emphasized. To operate trains successfully over a railroad an efficient car department organization must be set up in the train yard with proper facilities available, and above all, sufficient supervision. It has been proven in several large terminals that with proper supervision good results were obtained.

All major terminals on each railroad should have a general train yard car foreman, having complete charge of train yard inspection and repairs, with authority to set up his operation to bring about a more efficient performance. The title mentioned would permit him to work whatever assigned hours are required, to meet the needs of the job. It would also place him on a par with transportation officers he will be required to deal with. If car department officers display the proper enthusiasm and tell the management of our needs, why we want adequate yard supervision, that this expenditure will actually save money, etc., there will not be any hesitancy on their part to approve it.

(The report here included a summary of A.A.R. lubrication research activities of special interest to car men. The report was presented by H. J. Baker, superintendent car department, Pere Marquette District, C. & O.)

Discussion

W. M. Keller, director of mechanical research, A.A.R.: Mr. Baker is to be congratulated on a fine report. He states that all technical problems such as waste, oil, etc., should be studied by qualified personnel. This is being done and the A.A.R. has also called upon Armour Research Foundation and Franklin Institute to expedite and augment our research. These two groups have been busy at work for over a year but have not yet reached the point where they feel justified in making definite recommendations on the changes required. I can assure you that their research is both basic and thorough.

Mr. Baker mentions changing specifications to improve the bond between lining and back. About a year ago, we increased the zinc content of the back and placed a floor of 2.5 per cent under the minimum and moved the maximum to 4.5 per cent. This change was made because it was found that when bearing backs contained that range of zinc content the bond of the lining was greatly improved. Of course, it will be several years before the full benefit of this change will be realized, but a graduated improvement should already be in evidence.

We have had on trial in limited numbers for several years, a number of mechanical devices intended to improve journal box lubrication. In order to know the exact degree of improvement over the standard waste packed box that each one provides, accurate mileage or service records should be kept. Of course the car department officer requires the cooperation of the entire railroad to do this, but I believe if there are any cases where this record is not being kept, its importance should be pointed out to our higher officers.

Now we come to that thus-far perpetual enigma: Why do we have so many more hot boxes in the hot months of the summer than during cooler weather? Generally speaking, we have about four times as many hot boxes in July as we have in January. It seems logical that when waste is held by congealed oil or frozen moisture against the journal in sub-freezing temperatures that this condition would result in more thread risers, waste grabs and undesirable lnt conditions than is the case in warmer weather. Yet we seem to have more waste grabs in hot weather.

We have designed at the Research Center, Chicago, a bearing that is air cooled in the hope of improving hot weather journal bearing performance. The laboratory tests showed it to run cooler than when not so cooled. We are now testing it on the road where the average temperature drop below a standard bearing is not as great as we would like it to be. It is too early to predict what help it will be in solving the problem but I wanted to mention it to assure you that the laboratory is doing its utmost to support your efforts in the shop, car yard and train yard.

The A.A.R. is also attempting to make available to you all information that will assist you in this problem and is acting as an information clearing house to pass along any ideas that appear to have merit. We are hoping that our combined efforts will improve journal box performance but I am sure you will agree we are doing more than hoping for it—we are working for it.

Boiler Makers Turn to Diesel Maintenance Problems

A. F. Stiglmeier
Sec.-Treas.

H. R. Barclay,
President

Recommend water treatment, water tank, air reservoir and welding practices for diesels

STARTING its second half-century of service to the railroads the Master Boiler Makers' Association demonstrated its ability to adapt itself to diesel-electric motive power by presenting a program in which five of the six reports dealt with diesel maintenance. H. R. Barclay, general boiler inspector, Great Northern, who presided at each of the five sessions, pointed out that the association is rapidly adjusting itself to diesel work. Both A. F. Stiglmeier, secretary-treasurer and F. R. Milligan, vice-president, stressed the comback the association has made in this respect with Mr. Stiglmeier reporting the gains made in financial and membership standings.

The 51st annual meeting was addressed by G. L. Ernstrom, general mechanical superintendent, Great Northern, and D. P. Russell, supervisor, Bureau of Safety, Loss and Damage, Canadian Pacific. These addresses are reported elsewhere in this issue. Two other speakers were Allyn C. Breed, Bureau of Locomotive Inspection, Interstate Commerce Commission, and H. R. Cawley, mechanical assistant, Board of Transport Commissioners for Canada.

Mr. Breed told the M.B.M.A. that the change to diesels had a major effect on the Bureau of Locomotive Inspection, too, and he commented, "We both have had to learn to live with the diesels." He said a Master Boiler Makers' training in heavy plate work, layout experience and metallurgical knowledge would be particularly valuable in fuel and water tank work and in welding activities. Mr. Breed also cautioned the association about the tendency to postpone repairs to steam locomotives when the delivery of diesels is expected or when repair parts are not available. He urged that the promotion of safety be as vigorous in the present as in past years because the danger of accidents is always with us.

Mr. Cawley told the association about the work of the Board of Transport Commissioners for Canada, the board being similar in function to the Interstate Commerce Commission. He said all the board's locomotive inspectors have been to a diesel school and presently are being given on-the-job training to enable them to cope with the increased number of diesel locomotives and steam generators now being installed on Canadian roads. Mr. Cawley said that Canada is a leading industrial nation dependent on transportation and he reviewed the problems presented by that country's wide variety of climate and terrain.

In addition to the five reports carried in this issue in abstract form a report on the welding and brazing of individual diesel locomotive parts will appear in a later issue. This report was presented by Otto Gier, supervisor of welding, Great Northern.

Cleaning and Testing Steam Generator Coils

A committee report on steam generator coil maintenance was presented by Andrew J. Ritter, supervisor of diesel locomotive maintenance, New York Central, who was the committee chairman. Mr. Ritter reviewed early steam generator failures caused by lack of water treatment, soot and men with "tinkeritis". These difficulties have been largely overcome by the use of water treatment and developments in steam generator design. The committee presented the following method for cleaning and testing steam generator coils.

The best way to get the greatest life expectancy out of any steam generator coil is to keep them clean by acid washing and removing the soot as often as found necessary.

The strength of the washout solution is determined by operating conditions. When service is light and water condition is good the mixture of one part acid to four parts water is sufficient; where conditions are just the opposite a stronger mixture is used, as one part acid to three parts water.

Best results are obtained from acid washing if the solution is used at a temperature of between 80 to 100 deg. F, but at the same time care must be exercised not to have the solution above this temperature, since higher temperatures cause the inhibiter in the acid to become ineffective, allowing the acid to damage the coils and often resulting in failure. It is for this reason that coils must be cooled off by circulating water through them before washing.

It is important during coil washing to test the strength of the solution by any of the several known methods for it is possible that the solution has lost its strength giving a false indication that the coils are clean. When the solution's gas foaming subsides or the solution is thought to have lost its strength, the solution must be tested. If strength remains normal it is an indication that the coils are clean. However, if sample shows that the solution has weakened, acid must be added to bring the solution back to its proper strength, after which the washout is continued until foaming again subsides.

It is very important after acid washing to flush the system with a suitable alkali solution and follow with a rinse of clear water,

after which the steam generator is fired and allowed to blow steam through the steam separator blow-down valve for approximately 10 minutes, eliminating the possibility of any acid remaining in the system.

Another and very important item in determining coil life expectancy and in eliminating failure, is that the feed water be properly treated. This everyone knows can only properly be done in one way, that being, wayside treatment, treating the water as required. Properly washing and cleaning the water supply tanks is equally important. However, the subject of treating water and the methods of cleaning diesel locomotive water tanks is covered by other reports.

Some railroads have set up a practice of periodically removing the steam generator from the diesel unit and completely overhauling it. They have also set up the life expectancy of coils. When coils are removed during overhaul those found to have reached their expected length of service are scrapped; others are thoroughly cleaned outside by sand blasting and inside by acid washing. Before acid washing, however, coils are hammer tested as far as possible to detect any weak or worn sections in the tubing. After coils are cleaned and hammer tested a hydrostatic pressure of approximately 1500 lbs. is applied and allowed to remain for at least ½ hour. In allowing the pressure to remain this length of time porous spots and pin hole leaks in the tubing are easily detected and repaired when possible.

Washing and Cleaning Diesel Water Tanks

F. E. Godwin, chief boiler inspector, Canadian National, presented a committee report on diesel water tanks which was a sequel to the 1952 report on the same subject. (See Page 63, November, 1952, *Railway Mechanical and Electrical Engineer.*) An abstract of the 1953 report follows:

The manufacturers have a responsibility to meet—the future locomotive should be designed with the water tank as one of the major components and not as a left over to be squeezed in between the wheels or trucks with the usual claim that weight distribution is the reason.

As we all know, there are many types of water tanks in service on the various railroads, some of which have proven economical and efficient. As an example; the large capacity tanks on heating car units are troublefree due to the fact that the railways developed these tanks to meet their own requirements. Also the vertical type water tanks are by far the most economical tank to clean and inspect, as these are equipped with a manhole on the top giving access for proper inspection. Another asset is the concave bottom forming a sludge compartment which drains all sludge to the bottom dead center and facilitates the washing period.

The underhung type tanks are from all appearances a sealed unit made up of several compartments welded together into a honeycomb arrangement which leaves little to doubt that the designer had little knowledge of the sludge conditions existing in the hot water returning to the storage tank from the separators. Also, the heating of the water in the tank accelerates the chemical reactions and precipitates more sludge in the tank which has to be discharged by means of periodical washing if generator failures are to be averted.

The committee on this topic last year submitted sketches showing a method of cutting holes in the baffle plates for the washout nozzles and the committee this year endorses another arrangement to provide convenient washing conditions. The recommendation is to alter the design of the transverse or small baffle plates as shown on Fig. 1. The longitudinal plates require no change.

These changes can be made when the diesel is shopped for repairs. The removal of the top of the tank will be necessary in order to reach the baffle plates and the bottom, or rounded portion of baffles should be cut off on an arc at the opposite of the scolloped bottom, 4 in. up measuring vertically on center-line. The curved cutting line should have a radius of 42 in., making it comparable to the radius of the scolloped bottom portion of the tank.

This arched cut-out will effect all transverse baffles and as these are supported by an angle iron across the bottom, it will be necessary to remove this portion of the angle iron in the cut-out area to allow free passage along the entire bottom of the tank between the end heads and laterally between the sides and longitudinal baffles.

To compensate for the portion of angle iron removed from the interior a bottom one-half round standard beading iron, 7/16 in. x 1½ in. should be applied to the exterior under same area, extended slightly upward on the side of the tank and butted where scallops meet and fasten with weld all around. In this case, beading is a better substitute than angle iron for reinforcing as angle iron would be inclined to tear the bottom of the tank by its outward protrusion in the event of a derailment, whereas, the beading iron would be more likely to slide over an object.

On end heads washout plugs with sleeves should be welded to reinforcement plates, locating them centrally at the deepest portion of each scallop, as close to the bottom as conditions will permit. In all, sixteen plugs will be required—four on each head and four on bottom at each end. At these locations proper inspection will be permitted along the entire bottom of the tank

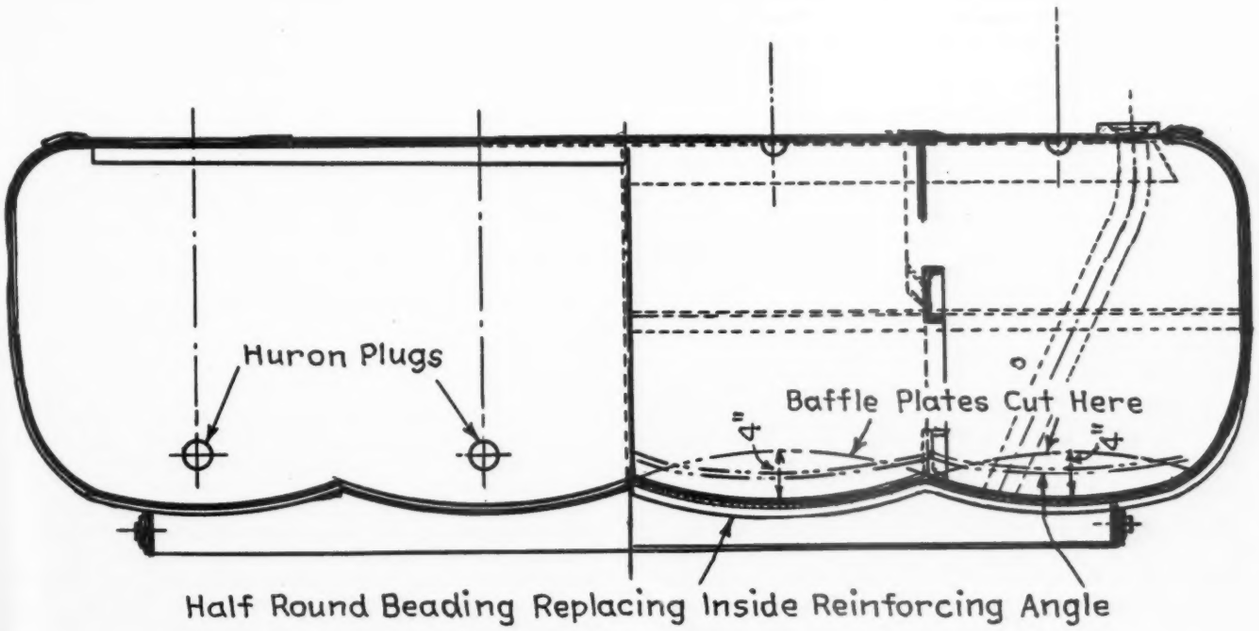


Fig. 1—Recommended to transverse baffle plates in diesel water tank.

SAFETY MUST BE BUILT INTO OURSELVES

Addressing the second morning session D. P. Russell, supervisor, Bureau of Safety, Loss and Damage Prevention, Canadian Pacific, listed three means of eliminating accidents—(1) Eliminate the hazard; (2) Provide a safeguard, and (3) Teach safe methods. In discussing these three points Mr. Russell said: "the first method, is naturally the most popular and to a certain extent the most certain. What it means, to cite an example, would be to move a pole in a yard, the location of which created a close clearance for men riding the sides of cars.

"However, it is not always possible to cut the squeal out of the pig, so we use a second avenue of approach, namely, providing safeguards. Specifically, this means action such as providing guards on moving machinery parts, goggles and such equipment where the nature of the work presents hazards they will eliminate. Such methods are sometimes called the engineering approach and have been and will continue to be very productive in accident prevention."

Even the elimination of hazards and the use of safeguards are not the answer, Mr. Russell said, using the high accident rates on super highways and the fact that 77 per cent of all fatal highway accidents occurred on straight roads to prove his point. He said: "The answer to safety cannot be found in the physical aspects of existence. Machines, buildings, all types of equipment, land . . . are but tools used by us; therefore, to achieve safety we must build it into *ourselves*. I do not believe that we can achieve safety by forcing everybody and everything into uniform molds, nor can it be achieved by letting things ride. Safety can only be found in co-operative effort by individuals impelled by a sincere desire to have te safest life possible.

"Another aspect of our relationships with others is the fact that many of us have another responsibility in safety over and above that of training ourselves. That is the responsibility which comes from being parents, supervisors on the job, leaders in the community, leaders in clubs and many other activities. Theoretically, it is possible for children to be careful if their parents are careless; it is possible that men in the shop will be careful even if the boss ignores safety; it is possible that the community will develop a respect for safety, even if their leaders pay scant attention to it. However, experience shows that wherever the leaders are lukewarm to safety, the atmosphere is progressively more frigid as you go down the line. On the other hand, the deeper the interest by the leaders, the greater and more successful are the returns on the effort expended."

lengthwise and at the same time will provide a straight passage for inserting a hose with a nozzle for washing, and also, the insertion of an inspection light, if necessary.

On the bottom at each end of the tank, close to the end heads in the deepest portion of the scallops, four washout plugs should be applied in the same manner as applied on the heads. These plugs will provide drainage of mud and scale when the tank is washed.

The application of sleeves to tank plates can be improved considerably if consideration is given to the following method.

The sleeve should first be machined on the outside with a slight taper towards the end that receives the plug. A reinforcing plate will be required of material thickness twice that of the tank steel. The diameter of the hole to be drilled in this plate should be equal to the mean diameter of the taper portion of the sleeve. Before attempting to weld the sleeve to the reinforcing plate make sure that the plug is securely tightened in the sleeve to prevent any distortion that may be set up during the weld application. The hole in the tank should next be marked off allowing the diameter of the hole to be cut 1/16 in. in excess of the large diameter of the tapered sleeve. The reinforcing plate with sleeve and plug applied are now ready for welding to the tank bottom or end section.

Washout plugs of 3⅜ in. in diameter are preferable, but none smaller than 2¼ in. in diameter should be used. Those located on the end heads are to be of the square head type, whereas on the bottom the recessed square hole type should be used so they will not protrude and become subjected to being struck by ballast or any foreign object in track when locomotive is in operation.

The above arrangement should be more desirable than the method of washing through side plugs, with corresponding holes in lengthwise baffle plates for long hose nozzle. By this method, washing is still a problem, as a great portion of the interior is still inaccessible and it cannot be assured that it is thoroughly cleaned. The most appropriate time to perform these alterations is when tanks are being fabricated by the builder. The additional work would be spared the railroads, including the headaches trying to keep them clean in the meantime. Also, we agree with the thought, as stated in last year's paper, that two coats of Apexior No. 3 or its equivalent be applied internally when new, for the prevention of any form of corrosion to plates.

Air Reservoir Inspection, Cleaning and Maintenance

A committee of which H. C. Haviland, supervisor of boilers, New York Central, was the chairman. recommended the application of washout plugs to air reservoirs and also had the opinion that hammer testing of reservoirs is detrimental. Because of constant air compressor operation on diesels the committee pointed out that considerable oil is pumped by worn rings from the compressor crankcase to the compressor cylinder. This oil mixing with dirt, dust and carbon and moisture in the reservoirs accounts for a relatively large accumulation of solids in the reservoirs. Continuing, the committee presented the following recommendations.

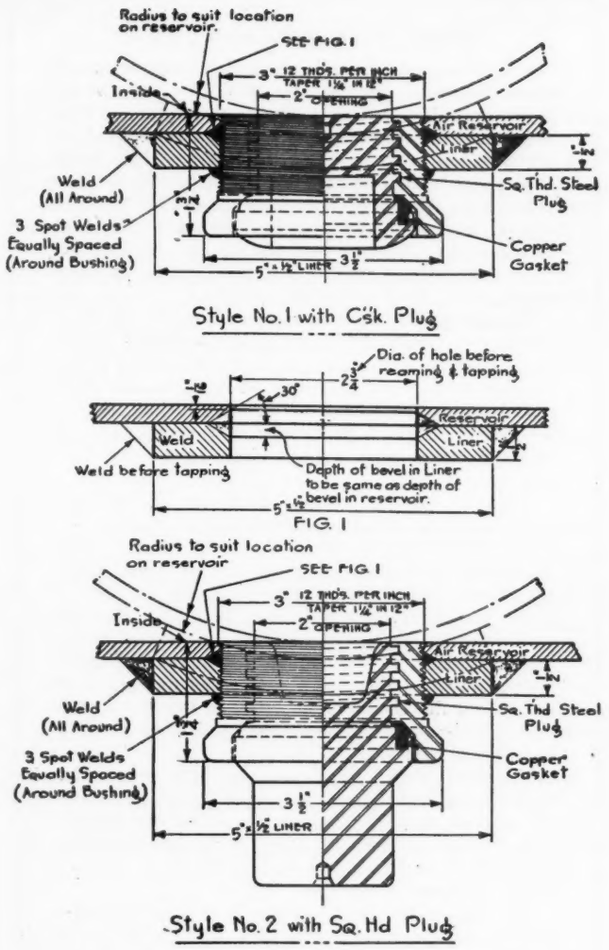
In most cases the washing of reservoirs, after periodical hammer-test or hydrostatic test, has been unsatisfactory because the only openings through which they can be washed are the openings provided for the pipe connections. In order to do this it is necessary to remove reservoirs of the larger type and stand them on end to perform this operation.

It had been suggested to our association that the application of washout plugs would facilitate the washing of air reservoirs. This suggestion with proposed method of application was referred to the Director, Bureau of Locomotive Inspection, Interstate Commerce Commission, and his reply was as follows:

"Receipt is acknowledged of your letter of Nov. 17th, 1951, together with print of sketch T-10-1951 illustrating proposed application of re-inforcing pad to air reservoirs to provide application of washout plug and in which you asked to be advised if the proposed construction would be satisfactory. Objection has not been interposed to use of new fusion welded main reservoirs incorporating welded re-inforcing pads provided the usual manufacturers certificates with which you are familiar are filed with this office. With respect to application of the reinforcing pads to older reservoirs we are of the opinion that such pads should not be applied unless it has been determined that each reservoir to which application will be made is in good condition; that hammer-test has been applied and upon completion of the work the reservoir be subjected to a hydrostatic test of not less than fifty (50) per cent above the maximum working pressure. Objection will not be interposed to the use of welding reinforced pads thus applied providing conditions adversely affecting safety do not develop in service."

The application of washout plugs would permit thorough washing of the reservoirs periodically without the necessity of dismounting the reservoir. This method would insure a clean supply of air at all times, and would prolong the life of the reservoir by the prevention of deterioration.

All main reservoirs should have washout plugs applied at or near the bottom of each head. The application of these plugs where the greatest accumulation of moisture and foreign substance is found, should alleviate conditions and may even eliminate the necessity of application to smaller, particularly on diesel locomotives, which are located in close spaces and it is, therefore, thought that this phase should have further study.



Method of applying liner and washout plugs to air reservoirs.

Washout plugs applied to reservoirs should provide a minimum opening of two inches. The plugs should be the square threaded type, but the choice between square head or countersunk plugs is a matter of clearances and convenience. Plugs of this nature would afford a ready means of washing the reservoirs, which in the light of present day evidence must be done quite frequently. The application of these washout plugs would also provide a means whereby a thorough inspection of the interior surfaces of the reservoir could be made.

In concluding the report the committee made the following suggestion on the hammer testing of air reservoirs:

It is the opinion of the Committee and our Association that if the necessary washout plugs are applied to air reservoirs at the proper locations considerable expense and time would be saved in eliminating the necessity of removing reservoirs for cleaning and testing.

It is also our opinion the hammer-testing of reservoirs is detrimental as this practice not only injures the metal but also flakes off the enamel on the interior surfaces which has been applied to prevent pitting and corrosion. The use of acids should not be resorted to in the cleaning of the interior of air reservoirs as this practice also removes the interior enamel.

Discussion

The opinion "that hammer testing is detrimental" was discussed at considerable length. In purchasing new welded reservoirs from air brake companies the point was made that the interiors are coated with interior enamel to prevent pitting and corrosion and hammer testing flakes off this enamel and promotes corrosion. It was believed that with washout openings permitting a good interior inspection that hammer testing might be eliminated on new reservoirs. Some members spoke of defects detected by hammer tests and were, of course, not in favor of the elimination of such tests.

Water Treatment for Diesel Cooling and Feedwater Systems

A committee under the chairmanship of H. M. Schudlich, engineer of water service, Northern Pacific, presented a comprehensive report on water treatment for both diesel cooling water and steam generator feedwater systems. This report appears below in abstract form, however, all parts dealing with specific water treatment procedures are included.

It is true that the diesel locomotive requires less water than the steam locomotive and it did not take the railroads long to learn that the character of this water for cooling systems and steam generators must be of a high quality and uniformity. The need for different requirements soon became quite apparent but not until some railways suffered material financial expenditures for unwarranted maintenance.

Diesel Cooling System

Corrosion ranks as the principle problem in the cooling system and it manifests itself in many forms. The most common form is the ordinary corrosion from oxygen and carbon dioxide gases dissolved in the water. These form a heavy uniform layer of rust on the cooling system interior or the oxides may be deposited in clumps or tubercles that seriously interfere with proper cooling, or may even restrict the water flow in constricted water passages so as to seriously damage the engine by over heating. Continued addition of fresh water makeup for evaporation and leakage losses furnishes additional reactive gases and corrosion progresses if not checked. The high temperature assists in aggravating the attack.

A diesel cooling system is composed of many metals in addition to carbon and rubber which present an ideal condition for galvanic corrosion. These many bi-metallic couples in the presence of an electrolyte is a potential source of involved corrosion. We find also crevice corrosion near the rubber seals on the cylinder liners which may be caused by a difference in potential between the unfilmed iron beneath the gasket and that of the passivated cylinder. Also important are fatigue corrosion from overstressed metal and the most perplexing type, cavitation-erosion. The latter type is the most difficult to control and probably is the most damaging. It is a complex phenomenon which causes metal loss by high frequency vibrations enhanced by mechanical erosion and electrochemical action.

The deposition of scale of any type and the formation of sludge which will deposit and accumulate at points of low circulation and in restricted passages, is to be avoided. Scale on the heat transfer surfaces will lead to overheating and metal failure and improper cooling will lead to both metal and engine failure.

The cooling water, therefore, should be of such quality so as to prevent corrosion and in order to prevent scale and sludge, be as soft as possible and free from unreasonable amounts of organic matter. Many railroad companies favor demineralized, distilled and clean oil free condensate, followed by sodium zeolite or lime-soda softened and low hardness, low chloride natural water in that order. Since the zero soft water will alleviate scale formation, it is only necessary to control corrosion. This is accomplished with various compounds. Chromates with the addition of various alkalinity producing salts, with buffers to maintain the pH in a range from 8.5 to 9.3, accomplish this purpose very effectively and give excellent protection against all types of corrosion. Naturally the mere presence of the chromate will not offer the protection desired and it is therefore recommended, that a minimum dosage of 130 grains per gallon be used. The normal concentration of chromate should be from 175 to 220 grains per gallon, with the higher concentration desired for combating the effects of cavitation-erosion. Since the protection afforded by chromates is dependent upon its ability to make iron passive, that is not entered into chemical combination with oxygen or carbon dioxide, it is thought that the high frequency vibrations which cause cavitation-erosion destroy the protecting film and higher concentrations of chromate are required to accelerate the self-healing film effect to provide the necessary protection. When using natural waters having a big concentration of chlorides, it is very desirable to use at least 300 grains per gallon of chromate.

Testing Procedures

Since low chromate concentrations are apt to increase corrosion and too much chromate is wasteful, it is very necessary to provide

an adequate control by frequent and regular testing for chromate concentration. This should be done at terminals and always at both ends of the run. This cannot be over-emphasized as dilution of the treatment concentration, because of leakage in the seals and gaskets and repeated refilling with untreated water, does produce an unsafe condition with respect to corrosion and scale. Flooding of the cooling systems by filling above operating water level is to be avoided at all times. There are several very satisfactory testing methods. The chromate concentrate of a sample may be read directly with the solubridge type of instrument; some railroads use color comparators, which are not too satisfactory due to the dyes inability to distinguish various shades of yellow, and some find hydrometers or blotter tests serving their purpose. The direct titration is the most accurate and this method should at least be used to check the accuracy of the other methods. An occasional pH is desirable, but since the compounded inhibitor contains the necessary proportions of alkalinity and buffers, only a very unusual water would materially alter the pH. Of course if trouble was being experienced the pH determination would be necesary to complete the investigation. It should be mentioned that the salts in the compound which automatically adjust the pH will also neutralize any calcium or magnesium scale-forming salts which are present when using low hardness natural waters in cooling systems.

Disadvantage of Chromates

There is no doubt that the chromate type of inhibitor is ideally suited for diesel cooling system radiators but unfortunately when carelessly handled it may produce dermatitis in certain susceptible individuals. (See Appendix A). This has prompted the leading treating chemical supply companies to develop other corrosion inhibiting treatments which are being used and tested extensively by many of the leading railroads. The results as to the effectivenes of these materials has varied, but it appears that continued research will no doubt produce a material that will be equally effective. This type of treatment can be effectively controlled by means of the solubridge type of instrument or by direct titration. The manufacturers usually recommend the minimum dosages required and will advise as to the testing methods which are rapid, simple and accurate. Frequent and regular testing is likewise important with these materials. It is claimed that the non-chromate type treatment can be used with practically any type of clear city water and that distilled and demineralized water are unnecessary.

Other chemical systems for conditioning cooling waters have been proposed and their effectiveness depends on the ability to provide a protective coating on the heat exchange surface, but this coating should not be so thick so as to retard heat transfer. Such systems are based on the use of chromates or silicates and polyphosfates in low concentrations. The use of polyphosfates alone, with relatively low pH values, does not produce consistent results.

The most satisfactory type of application of any cooling system water treatment will vary with the individual road and will depend upon a number of factors, which include the number of diesel locomotives to be watered, number of points at which water is taken, personnel available at these watering points and to a great extent their reliability. Some roads prefer automatic proportioning equipment, but the majority seem to favor adding the solid chemical directly to the cooling system. In general, the locomotive builders have not seen fit to cooperate with the railroads so as to provide a convenient, safe means of adding the cooling system treatment. A few roads are installing a bypass feeder arrangement around the circulating pump on the engine. This type of feeder can be installed at a very nominal cost, and from the standpoint of convenience helps to insure that the treatment will be properly added. Considering safety alone, the installation of such a feeder can be more than justified.

Steam Generator Feedwater

Scaling, corrosion and sludge accumulation are the major difficulties encountered with the operation of steam generators on diesel locomotives. The builders at first inferred any water could be used and recognized that moderate or haphazard treatment might be necessary as evidenced by the presence of the bypass feeder originally installed on most locomotives. The use of brick, stick or ball water treatment chemicals applied by these feeders is frowned upon because of severe mechanical limitations of the equipment and the unreliability of replenishing the chemical supply. The temperature of the feedwater is the governing factor in the dissolving and the proportioning of the compound and the variation in temperature makes it almost impossible to proportion the chemical and feed a proper amount at the beginning of a run, when the feeder is filled, as at the end of a run when the feeder is almost empty. This type of equipment is rapidly being supplanted and augmented by more suitable off-the-locomotive treating plants.

Types of Treatment

Demineralization seems to rank first as a choice of treatment for efficient trouble-free generator operation. This is done off the locomotive. The water is first passed through a cation exchanger which converts all the positive radicles to the corresponding acid. The water next passes through the anion exchanger which absorbs the acid leaving pure water with its dissolved gases. A deaerator removes most of the carbon dioxide and the water is then post treated with selected organics to neutralize or fix the oxygen, and caustic soda, potassium carbonate or soda ash to provide the very necessary excess alkalinity. Compounds that are specially blended for this post treatment are readily available and give excellent results. The feeding of 0.5 to 0.7 pounds per thousand gallons should produce a water with a pH of 8.5. Demineralization is the most expensive method of treatment, the capital expenditure

BOILER SUPERVISORS AND DIESELS

G. L. Ernstrom, general mechanical superintendent, Great Northern, addressed the M.B.M.A. on what the boiler supervisors can do to educate themselves for other positions, a subject of primary concern because of the curtailed use of steam power. He said: "Many boiler supervisors in the past have taken their turn in handling roundhouse shifts, especially since the five-day week for supervisors was established in 1949, and they have demonstrated they are as capable in handling the supervising of mechanics of other crafts as other supervisors.

"Speaking from my own experience on the Northern Pacific, we realize we have a moral obligation to our boiler supervisors to make the best use of their talents possible so we sent a number of them to the diesel schools along with supervisors of other crafts. We feel we have been amply repaid for the expense incurred by the excellent supervision of diesel repairs they have rendered.

"Unfortunately, in the past the ability of our boiler supervisors was not always recognized so that the best talent was not always selected for promotion to more responsible positions. Because of that, many boiler supervisors confined their activities along the lines of boiler maintenance exclusively. With the changing conditions the past few years I am sure you all realize this laxity must stop if you are to continue as supervisors. The fact that diesel supervision appears to be out of your line should be no deterrent toward adapting yourselves by study and acquainting yourselves in adopting modern methods.

"On the Northern Pacific we have been endeavoring to keep our boiler forces employed by manufacturing in our own shops all such items as we can produce with our own equipment. Many of the specialties that we formerly purchased are now produced in our own boiler shops and at less cost.

"At the present time we have a number of boilermakers on bridge structural work at a former steam locomotive shop that has been converted to handle the greater portion of our diesel locomotive shopping. They are also repairing diesel locomotive cabs, ventilators, filter louvers, performing underframe welding, manufacturing steel pilots and body panels, and it appears that we will retain most of our remaining boiler forces for that type of work and no doubt as time goes on we will find that there are additional items that can be handled by our boiler forces."

is high but the water is pure—returns no sludge to the storage tanks, and eliminates all scaling of small piping and moving parts.

Evaporators and condensate furnish a pure water but this too must be post treated with the proper chemicals to prevent corrosion, and provide the necessary alkalinity, but this water is too expensive to consider for a permanent supply, more especially where the consumption may run into large quantities.

Sodium zeolite softeners rank next in poularity for use with the harder water supplies. There are many types of these softeners available and their use is recommended for several reasons. Some are available that are entirely automatic, others are semi-automatic and these types assist in reducing labor costs. The hardness of the water can be reduced to zero, thus eliminating all scale-forming salts. The capital investment for zeolite softening chemical maintenance and operating costs are substantially much less than with demineralization. Sodium zeolite requires only common salt as a regenerant instead of the difficult to handle acid and provides a relatively alkaline water which requires slightly less after treatment. The post treatment in this type of water should include organic oxygen removers, with sulfate raw waters sometimes more alkalinity, and the newer type organic antifoam reagent if the water is being used with the forced recirculation type steam generators.

Many of the railroads have existing lime-soda softeners which provide water of good quality and which will give good results in steam generator operation. These waters must be given the post treatment mentioned before to prevent corrosion, bring the alkalinity excess up to 35 to 50 per cent, and to provide antifoam when used in the forced recirculation generator.

Wayside Treatment

A large number of roads are also using the wayside internal method of treatment and are having excellent results when it is properly handled and controlled. The compounds used have a wide range of ingredients for the purpose of preventing scale, sticky sludge and corrosion. General opinion seems to be that the most satisfactory ingredients for treating a wide range or variety of waters are potassium compounds incorporating organic sludge conditioning reagents, antifoam reagents, and oxygen-fixing compounds. It is of interest to note that the phosfate-based compounds produce a sticky sludge in combination with magnesium containing waters, especially when the feedwater is recirculated or cycled and the phosfates have been reverted by the heat to the ortho form. In a general way the internal type of treatment is limited to the softer waters and some roads have limited this type of treatment to raw waters with a maximum hardness of five grains.

Many means for feeding internal treatment are being used. The best method of application of the compounds to the feedwater will depend to a great extent on the requirements of each individual railroad. Consideration must be given to the number of steam generators, number of watering stations, length of runs, quality of treatment required and availability of competent personnel, but in general the most satisfactory method is that by which all the water is properly treated by automatic feeders before it is pumped into the storage tanks aboard the diesel. Wayside plants can be more readily inspected and maintained. Less trouble will be experienced since proportioning of the treating chemicals can be suited to each individual water supply, whereas treating on the locomotive requires a dosage for the worst water condition to be at a bare minimum in order to reduce over treatment of the softer supplies. Mechanical proportioning on the locomotive is only recommended where water conditions at each station do not vary greatly from the average. A possible exception could be a road having only a very few diesels but which units would take water at a large number of stations. Some roads have had some success by hand feeding the treatment into the watering hose. This method requires active and alert superivision and then the results are not the best, since the treating chemicals are approximated.

Regardless of the type of treatment, control is of major importance. Blowing down the separator to reduce the dissolved solids and sludge is necessary. Samples of the raw and treated waters must be analyzed to know that the proper amount of treatment is being added and this should be checked further by analyses of the separator water or the boiler water in the forced recirculation type. There are basic minimum dosages of treatment required and these must be strictly adhered to in order to provide economical, trouble free and reliable steam generator operation.

Appendix A

While chromates appear to be the most suitable chemical for corrosion prevention there have been several cases of juries awarding kingsize judgments against railroads in favor of employees who claimed damages because of dermatitis due to handling the chromates. It must be recognized that there are many chemicals that will cause dermatitis and it is estimated that 30 percent of industrial dermatitis is caused by petroleum, its products and alkalies. There are found in the diesel shop various kinds of oil, oil additives, degreasing compounds, coal and dusts, creosote, various kinds of cleaners for all purposes, and tars; to mention only a few, that can cause skin irritation to a certain class of individuals. Many of such irritants are found around the average home, the workshop and the private automobile. Only a small percentage of industrial skin disease is due to allergy. Most of it is due to exposure to materials known as primary irritants, and thus anyone can be effected. Skin disease in industry can be controlled by the practice of personal and hygienic measures.

It appears that the symptoms of allergy are due to purely nervous or emotional strain. Often it is found that strain sensitizes a person so that he can react more violently. This sensitizing influence of nervousness and fatigue can be found in certain persons. It therefore follows that the employee who is under an undue emotional strain must exercise far more care than the average individual and the prevention of dermatitis becomes a personal problem of mental and physical hygiene.

There can be cooperation on the part of the employee if certain basic precautions are followed. The prevention of skin contact; the use of proper gloves, if some material does come in contact with the skin it should be removed promptly with approved cleansing agents. Harsh and strong soaps tend to defat the skin and cause excessive dryness and cracking and tend to reduce the skin resistance, resulting very often in an oczematous dermatitis. It is therefore essential to use a superfatted soap or cleanser containing a very mild abrasive, such as cornmeal for cleaning up.

There are on the market several mild skin creams that form an invisible plastic-like film on the skin to protect workers when exposed to irritating chemicals. These should be used on clean skin before starting to work and they will assist in maintaining a high skin resistance. Clothing that is kept clean and suitable for the work should be worn and if these few simple precautions are followed, dermatitis would not be a problem.

Preparing Steam Boilers for 30-Day Away-from-Home Period

A committee headed by M. R. Francis, general boilermaker, Norfolk & Western, presented a report on recommended practices for preparing steam locomotive boilers to remain away from home terminal for 30 days. As stated in the report the major part of the paper is naturally a review of several reports presented at M.B. M.A. meetings in the past. The committee made particular reference to the value of good workmanship in the back shop in making heavy repairs if the enginehouse staff is to prepare a locomotive for 30 days of trouble-free service. It also pointed out the importance of water treatment and blow-down equipment and practices. In addition to covering the washing, inspection and repair of boilers and tenders gave the following new information about arch maintenance.

Locomotives operated with part brick arch or defective brick arch are wasting fuel and also present a very undesirable smoke condition. There have been some improvements made on maintaining a constant brick arch and reducing arch consumption. Some railroads are sealing their arch with a dry-set cement, and in some cases this has proved very satisfactory. Some roads have changed from arch tubes to other methods of arch support such as security circulators and siphons, which tend to maintain a more constant arch, but in some cases present more firebox maintenance. One railroad is now in the process of applying a chrome ore arch, using studded arch tubes connecting in the crown sheet to the side sheets, requiring 30 2½" O.D. tubes. It is hoped that installation will go a long way in solving brick arch maintenance. Locomotives reported riding rough should be given prompt attention by the roundhouse forces, as a rough riding locomotive is certainly a contributor to bad arch conditions.

What Happened at the 45th Air Brake Meeting

Members discuss possibility of a separate air brake craft and learn how to train men, handle, maintain, test and standardize equipment, and how three new equipments perform

R. F. Thomas, President

L. Wilcox Sec.-Treas.

WHAT could be the seed of an idea of far-reaching importance in improving train operation through a better air brake maintenance arrangement may have been planted in this year's Air Brake Association meeting when a separate craft for air brake men with its own seniority list was advocated and discussed.

A separate air brake craft was felt to be desirable because it would eliminate situations wherein an experienced air brake man is bumped off the job by a man with more seniority who may have had little or no air brake experience. Today's air brakes are too complicated to be serviced by inexperienced personnel, and the railroads cannot afford to spend months or years training a man in their repair or operation only to have him displaced at any time by a man who has spent the greater part of his working life on other parts of a car or locomotive.

While there was general agreement on the desirability of a separate air brake craft, some of the difficulties that might be expected in attaining this were pointed out, such as separate organizations today for car and more locomotive work from which comes the air brake man. One road has consolidated all air brake repairs at one point. While the jobs are separated as to those handled by car air brake men and by locomotive air brake men, the work is done at the same general location and under the same foreman. Another suggestion to improve air brake performance was to have the air brake supervisor report directly to the vice-president of operations to give him the authority he needs to do a good job.

Graphite as a Lubricant

A new brake cylinder lubricant was felt to be needed by several members. One, whose roads uses dry graphite only, except where required by the AAR, thought oil and grease outmoded as brake cylinder lubricants. One member thought oil and grease caused rubber, neoprene and Buna N to swell, although another said that his road used grease and had no swelling.

Tomorrow's Craftsmen—How To Get Them

By L. B. George

Assistant Chief of Motive Power and Rolling Stock
Canadian Pacific

Before World War 2 tradesmen in the railroad shop crafts were practically 100 percent skilled mechanics who had served a full apprenticeship. Their labor organizations would allow only those who possessed credentials, showing they had served apprenticeship, to enter their ranks. This gave them a certain degree of protection and security as well as a good bargaining position. The railroads were likewise quite satisfied as they were guaranteed fully qualified personnel within their shop crafts.

The past 14 years changed this. The war, compulsory military training, and heavy traffic demands put expert craftsmen at a premium, requiring the upgrading of helpers and laborers.

Upgrading has made it difficult to obtain young apprentices because they know, or they soon learn, that they can be accepted to a craft and obtain full compensation rating after a few years' experience as a helper. Some of these young men, hired as helpers, have made a success of their work, but this is an exception rather than the rule. Only by stopping upgrading as soon as possible and by re-establishing the apprentice system, will we have able mechanics to take care of our future needs. This, of course, will require the full co-operation of the labor organizations.

To achieve this aim, management and labor organizations

IN ORDER TO GET TOMORROW'S CRAFTSMEN, WE MUST:

1 **Stop upgrading helpers.**
2 **Restore normal apprentice ratios.**
3 **Make apprenticeship attractive.**
4 **Extend apprenticeship to five years.**
5 **Make advancement available to the skilled.**

should agree to discourage upgrading and to improve the apprentice ratios until conditions are again normal—a deadline must be set, after which upgraded men are not permitted permanent seniority standing as craftsmen. Any exceptions for upgrading should be approved by a committee representing the railroad and organizations affected, this committee or board to exist only until sufficient apprentices are being trained.

We should insist on fully qualified personnel on our permanent seniority lists to secure efficiency and to retain our place in the transportation field.

A step backward has been taken in the practical training of craftsmen. Not so long ago an apprenticeship was 7 years. Most of us today served at least 5 years, working 9 hours a day, 6 days per week. During recent years the hours have been reduced to 8; the work week to 5 days, and apprenticeship to 4 years.

"I am in accord with the shorter hours and the shorter work week, but definitely not with reducing the apprenticeship period to anything less than 5 years . . . . With all the technological advances of this machine age, it is more imperative than ever for a skilled craftsman to receive a good, sound, basic shop training and, the more experience he can acquire during the period of training, the more proficient he becomes in his craft and the more valuable to the company which employs him. Furthermore, his prospects for advancement and future success in life are greater."

To attract the right type of young men representatives from both railroads and unions can address graduating classes and explain to them the work done by the various crafts, highlighting the advantages of being employed by a railroad, and using moving pictures or directed tours through railroad shops to stimulate students' interest in this avocation.

In the smaller points, where railroads are well established in the community life, no trouble is experienced in obtaining a good type of young man to serve apprenticeship. Most outstanding apprentices come from small towns and cities.

The problem is confined to the larger centers where principal repair shops are situated and most apprentices hired. The CP is compiling a booklet entitled: "Introduction to a Future," for distribution on such occasions. Efforts in speaking to graduating classes, particularly in large centers, have already proved quite fruitful.

How CP Trains Apprentices

In company schools, each apprentice, receives at least 500 hours training, principally in mechanics, trade theory, mechanical or trade drawing and blueprint reading. All classes are held on the company time. Under the training programme some 950 apprentices are receiving training in 12 different skilled crafts at the main shops, roundhouses, diesel shops, coach yards and freight car inspection and repair points.

Annual system examinations are conducted in each craft for first, second and third year apprentices, and prizes provided by the railroad for those passing with a high standing. The company expects each apprentice to study at home at least two hours per week and this provision is written into the apprentice application form.

Apprentices with special aptitude are encouraged to seek higher technical education. Three free scholarships, covering 5 years engineering are offered each year. These scholarships are subject to competitive examinations taken by apprentices under 21. Scholarship winners are expected to complete their apprenticeship and are allowed to work in shops during off-school periods.

Any apprentice who has completed 2 years of his apprenticeship and wishes to continue his education in engineering is permitted to attend university if he continues his apprenticeship.

Special training as mechanical assistants, lasting for 2 or 3 years, is provided for those graduate apprentices who show qualities of leadership. It is not necessary that they be graduate engineers or scholarship winners, because this scheme presents opportunity also for those who, for various reasons, were unable to take higher education in the normal way but have shown natural ability as well as the appearance and personality to qualify as good supervisors.

Special training is limited and only sufficient graduate apprentices receive such training as are required to fill certain positions, as it is fully realized that such a plan could be abused and the incentive of others greatly impaired. Sufficient scope, therefore, for advancement for every skilled employee must always be available. This is necessary for the general welfare and morale of all employees as a whole.

Complete records are kept of each apprentice at headquarters, showing his progress and experience in the shop as well as his educational particulars and information as to his outside interests, personality. etc. Such pertinent facts on attending university extension courses, technical school or trade schools, taking public speaking or correspondence courses, etc. are all recorded and kept up to date. These records have proved of great value when surveying the field and looking for prospective future supervision.

Stopping Trains from the Rear

The contention has been made that no matter how you stop a freight train from the rear, you would be complying with somebody's instructions. A survey of the variation in instructions to conductors and to enginemen on 22 roads shows that this is not far from true.

There is no question that, in an emergency, the handiest valve in the caboose should be opened wide as quickly as possible, to apply the train brakes in emergency. But if it is desired to make a service stop, due to a hot journal or stuck brake, etc., it is necessary to know how the brakes operate and their effect. Remember, the instructions issued must apply to all freight trains on any physical characteristics. If the handle of the A-1 caboose valve is placed in the first notch on a short train, you will get a heavy blow at the valve, but the feed valve will overcome the leakage. There may be no brake pipe reduction and if so you will not apply one brake in the train. If the train is long and the leakage is normal, that is, 3 or 4 lb. evenly distributed, you will get about 6 or 7 lb. reduction on the caboose gage. If the train is long and has excessive leakage near the rear end (which may have developed en route) the brake pipe reduction on the rear may be as high as 20 lb.

As trains cannot repeatedly and successfully be stopped from the rear in the same distance as the engineman can stop, the instructions should be worded so trainmen will not expect results identical to that of the engineman's handling. The man applying the brakes from the caboose finds the train does not react as soon as it does when the engineman applies the brake. He then will, unless properly instructed, decide the caboose valve doesn't work and open it wide. The brakes then work good.

Cylinder Pressure vs. Reduction

If the brake pipe reduction is 6 lb. or more the brakes apply on all but the head 6 or 8 cars. The brake cylinder pressure will depend on the total brake pipe reduction. A reduction of 6 lb. will result in a brake cylinder pressure, on most of the cars, of approximately 10 lb. A 10-lb. reduction gives 17-lb. brake cylinder pressure, a 15-lb. reduction gives 34 lb. These different brake cylinder pressures greatly affect retardation rate, as do the weight of the cars and the physical characteristics of the railroad. Therefore the initial rear end reduction must not exceed 6 lb. to avoid retarding the rear cars of the train sufficiently to cause harsh slack action (this because slack may be bunched when brakes are being applied).

A train of heavily loaded cars moving 30 m.p.h. on a descending grade may move a half-mile before the slack is fully stretched. If the reduction on the rear is increased before this slack is fully stretched, you will get the same undesirable result as making a heavier application in the first place.

If the train is slowly moving up an ascending grade or has had the brakes applied on a descending grade long enough to reduce

to low speed, and a heavy reduction is then made on the rear end, the rear end of the train may set down before the increase in brake cylinder pressure is effective in the midle or head end of the train. This will result in a train parting. Therefore, it is necessary to make reductions following the first one very light, and space them sufficiently to note results.

Moving the A-1 caboose valve from the first to the second notch will increase brake cylinder pressure up to 30 lb., depending on such conditions as length of train and amount and location of leakage. Instead of moving valve from the first to the second notch, move the valve handle sufficiently to increase the brake pipe reduction 2 lb., which will increase the brake cylinder pressure approximately 6.5 lb. One or two reductions like this are usually ample to stop any train.

Engineman's Cooperation Essential

The engineman must cooperate or we can still damage draft gear. Years ago we learned that when making a service stop with a freight train, it was necessary to make a final reduction just prior to train coming to rest, or the stress on draft gear would be sufficient to cause damage, especially with empty cars or light loads on the rear. This still applies. If the air is applied properly from the rear and the engineman does nothing, a drawhead may be broken just as train comes to rest. If the engineman laps the brake valve at high speed, the brakes on the head end will apply in approximately 12 seconds and some slack will bunch. Then as the train comes to rest this slack may run out again and possibly result in draft gear damage. The engineman should therefore gradually close the throttle when he notes brakes are being applied; unless the locomotive is equipped with a brake pipe flow indicator, the first definite indication the engineman has that the brakes are being applied is the reduction in speed.

As speed continues to reduce, the dynamic brake, if in use, should be gradually released. When the speed has reduced to about 6 or 8 m.p.h., he should place the brake valve in lap position, allow the locomotive brake to apply and drop sand.

Instructions issued to crews must apply to any train, regardless of speed, on any physical characteristics. These instructions must call for an initial reduction sufficient to apply brakes, but the application must not be heavy enough to run the slack out harshly if the train is moving with slack bunched.

It must be remembered that by complying with these instructions, it is impossible to stop a train at a particular location, for instance, to clear a sliding switch. When this is attempted the instructions are forgotten and damage usually results.

This report was prepared by F. R. Ellis, air brake instructor, Reading.

Discussion

One road found that setting brakes from the rear applies the brakes on all but the head 14 cars, not 6 or 8, and therefore the final application must be made by the automatic brake. Another road reported no break-in-twos where locomotives are equipped with the brake pipe flow indicator. A third line has no trouble in the final stop, but does as the valve goes to the second position at high speed. A fourth stops 150-car trains with no coupler failures by opening the valve to the first notch and not moving further until the pressure stops falling.

One member thought that future freight train brakes should have four characteristics: (1) Deceleration proportional to pressure; (2) brake torque proportional to car weight; (3) sufficient brake thermal capacity to continue (1) and (2) with any weight car; and (4) all brakes apply at the same time, which would require electric control. Commenting on these recommendations, another member said that his road operates a dozen passenger trains with the electro-pneumatic brakes and averages about one failure every two weeks. He wondered how reliable the electric brake would be on trains of 100 or more cars. He thinks that the disc brake, which would attain recommendations 1, 2 and 3, could be adapted to diesel and freight car applications but wondered if there would be enough benefit when most freight stops are made from less than 50 m.p.h., below which speed the cast iron shoe has approximately constant friction. He also thought that freight disc brakes would get poor maintenance at first as the man would have little experience in maintaining them, also that repairs would not be centralized as they are in passenger brakes. However, he favored the idea if the above problems could be solved.

Air Compressor Lubrication

In a reciprocating air compressor there are several types of relative motion, each of which presents a separate lubrication problem. The relative motion of the connecting rod bearings and main bearings with the shaft is purely rotary, creating a high-pressure oil "cushion" in the clearance between the bearing and the shaft, a condition is known as thick film lubrication. The oil pressure existing in the lubricant film is a result of rotary motion only and will usually be at least several hundred times as great as the oil pressure built up by the oil pump. This high-pressure thick oil film determines the load capacity of the bearing, with the pump pressure serving only to maintain the oil in the clearance space against leakage around the edges of the bearing.

Where compressor main bearings are of the ball or tapered roller type, lubrication is relatively simple and usually accomplished by splash methods.

The relative motion between the piston wrist-pin and wrist-pin bushing is oscillating. This motion plus rather low velocity prevents build-up of oil pressure higher than that provided by the oil pump. In compound compressors the wrist-pin load of the high-pressure piston is always on the side opposite the connecting rod, requiring a lubricant with high film strength. The wrist-pin load of the low-pressure piston wrist-pin reverses twice in each full stroke, distributing the bearing load more evenly. Wrist-pin lubrication, however, is always thin-film and so requires a high film strength oil.

A secondary purpose of lubrication is to carry heat from the moving parts to the oil sump where it can be more readily radiated to the atmosphere. The oil sump temperatures can be expected to reach at least 200 deg. F., the connecting rod bearings, pistons, and upper cylinder walls considerably above the sump temperature, and the air discharge from 400 to 500 deg. F.

Another requirement of air compressor lubricant is its ability to provide an air-tight seal between the piston and the cylinder wall. For this purpose the lubricant should have high film strength and good heat stability.

Cylinder Wall Lubrication

To get adequate piston lubrication, a thin film of oil must remain on the cylinder walls at all times. Too much oil escaping past rings into compression chamber is uneconomical and can damage air brake operating devices served by the compressor.

Excessive oil passing may result if a new or rebuilt compressor is improperly worn in. If such a compressor is immediately subjected to severe operation conditions, scoring and galling of the cylinders is quite likely to occur, with consequent oil passing for the remainder of the compressor's service life or until the damaged parts are replaced.

Break-in Procedure

A new or repaired compressor should be worn in for 5 to 8 hours. Starting with a speed of from 400 to 450 r.p.m. and discharging to atmosphere, the speed and pressure should be gradually increased until full service conditions are reached and maintained for several hours. Auxiliary oil injection into the air intake should be employed to lubricate for the upper cylinder walls during wear-in. Oil injection should be continued until the final stages of wear-in.

Improper care in reassembling a repaired compressor will cause poor ring contact and high cylinder temperatures, resulting in excessive oil passing and possible failure of the machine. The oil passing rate of such a machine is likely to be high until misalignment is corrected to some extent by excessive wear. Tests have indicated that a misalignment in perpendicularity of the piston to the cylinder of as little as 0.007 in. in a compressor with a 6-in. stroke will shorten service life and may cause seizure.

Sustained high operating temperatures are conducive to vaporization of the lubricating oil and consequent loss of oil into the compressed air. High temperatures also increase the tendency of the oil to oxidize, a by-product of which is the formation of compounds of an acid nature which may cause corrosion. If high temperatures cannot be avoided, their effect can be overcome somewhat by oil with proper viscosity and good heat stability.

Oil Consumption vs. Load

It is commonly believed that a compressor running unloaded will use more oil than one running loaded as the crankcase

pressure is higher than the cylinder pressure, forcing oil past the rings. Tests have proven that though this pressure unbalance condition does exist, it is not a major factor in governing the oil passing rate. Recent investigations of this subject show that a compressor which would pass about a quart of oil every 30 hours when continuously loaded would pass no measurable amount of oil in 120 hours unloaded. Tests for various load cycles further indicate that the oil passing rate varies directly with the percentage of time that the compressor is loaded in a given operating period, mainly due to higher operating temperatures on a heavy load cycle.

Dirty inlet filters can cause abnormal oil passing because the increased pressure differential across the piston forces oil into the compression chamber on the intake stroke. Restriction also will reduce volumetric efficiency, increasing the load cycle and the temperature.

Excessive oil vapor in the air causes formation of carbon on discharge valves and compressor heads. This causes a gradual drop in compressor delivery and is likely to bring about valve failure. Dirt in the intake air is conducive to the formation of hard carbon deposits in the presence of excessive oil as it provides a nucleus about which the oil particles can collect. Excessive oil passing, particularly where high temperatures exist, will also show up in the formation of "varnish" and oil-water emulsions in air-operated devices served by the compressor. This requires excessive maintenance of the devices and may cause complete failure under some circumstances.

The presence of oil and oil vapor in the air lines and reservoirs may cause fire and explosion under certain conditions if the temperature of the air exceeds the auto-ignition temperature of the oil. Carbon formation increase the danger of fire and explosion in that it tends to hold heat and so act as a "glow plug" ignition source.

Qualities of a Good Compressor Oil

The addition of detergent and dispersant additives to compressor oils remains a controversial subject. There are no definite data available showing whether any benefit can be derived from additives. There is, however, little reason to believe that such additives have any seriously damaging effect on the compressor. Oxidation and corrosion inhibitors are frequently used to advantage in compressor oils.

In the selection of an oil to meet these specifications, certain standard tests are usually employed. While these tests can not fully evaluate an oil's suitability for compressor service, they are valuable in controlling the quality of oils found by experience to be best for this service and in eliminating those oils having definitely unsuitable qualities.

A good compressor oil should meet the following minimum requirements:

1. It should be a well refined mineral oil with high film strength and free from saponifiable and fatty oils and fillers.
2. High heat stability to withstand high temperatures without oxidizing excessively, without forming too much carbon and without developing too much acidity.
3. A tendency to form soft fluffy carbon rather than hard carbon.
4. Low percentage of relatively volatile constituents which tend to be carried into the air stream to cause "varnish" deposits.
5. Flash point above 400 deg. F., fire point above 450 deg. F., and pour point 25 deg. F. or lower.
6. Viscosity should be preferably S.A.E. 30 and not higher than S.A.E. 40.

Discussion

A series of tests on a 1,335 mile run of two different passenger trains showed the consumption varied from a few ounces to a quart per run. This was small but it could cause trouble. Oil used varied from SAE 20 to SAE 40. The heavier oil generally showed slightly less consumption, but there were enough exceptions to this rule to decide that this might not be the full answer. In a canvas made of a number of roads it was found that 5 per cent used SAE 20 oil for compressors, 19 per cent SAE 30 and 76 per cent SAE 40. Further, 38 per cent used straight mineral oil and 62 per cent used detergent oil. One road found that the addition of a small amount of molybdenum-disulphide reduced friction and high break-in temperatures. It was asked if an oil for diesel engine crankcases would fulfill the five minimum requirements for compressor oil, and the answer was "yes" in the case of SAE 40, used in over 90 per cent of diesel engines.

Electro Motive originally recommended SAE 40 oil except in extreme cold climates; they now recommend SAE 20 except where the ambient is high. This change originated because many troubles were found to occur just before the weather got cold.

Road Service Trials of the Type B Brake Pipe Flow Indicator

The brake pipe flow indicator shows the engineman two conditions heretofore relatively difficult to ascertain. First it will reliably tell him, while running over the road, (1) that the brakes on his train are being applied from the rear end or, (2) that an increase in brake pipe leakage of sufficient magnitude to initate quick service is taking place. The second purpose is to indicate during a release of the brakes that all normal brakes have released. The first is important because of the tremendous pulling power of diesels. The second indication is also important in that it tends to eliminate false starts and pull-aparts by telling the engineman that flow in the brake pipe has diminished to such a point that all normal brakes are released and that it should be satisfactory to start the train.

The type B brake pipe flow indicator with which this paper deals incorporates the following features:

(a) Continuous dial indication calibrated from 0-9 p.s.i. differential between the feed valve pipe and the brake pipe at the brake valve.

(b) A single point lamp indication which can be set for any desired value within this range. This can be either an *application* setting to indicate, by the light coming on, that a brake application has been initiated at some point in the train, or a *release* setting to indicate, by the light going out, that the brakes can be expected to have released throughout the train. Either setting is a pressure differential that is calibrated for each type of locomotive brake equipment.

(c) A manually adjustable auxiliary pointer (red) which may be set for the selection of any other desired visual single point indication to which the railroad may wish to alert the engineman.

An adjusting screw provides for varying the setting of the indicating light to suit the service for which the instrument is intended.

Conclusions From the Tests

Limited data obtained from tests on six trains under actual service conditions disclosed that the indicator properly performed its primary functions of (1) producing a LIGHT-ON indication during each train initiated brake pipe reduction of sufficient intensity to propagate quick service activity throughout the train, and (2) indicating that the train brakes had released when the indicator hand returned to the RELEASE setting following a full-service brake application. Also, the test confirmed that previously made calibrations for the application and release settings are satisfactory.

The test confirmed that the recommended release settings are satisfactory for indicating that all brakes in good operating condition have released following a full-service application. The time from movement of the caboose valve to one of the application positions until the LIGHT-ON indication was obtained in the locomotive cab varied from 20 to 45 seconds. Different caboose valve manipulations and train conditions account for this variation. However, in each instance where a caboose valve test was made the LIGHT-ON indication was obtained to warn the engineman of a radical change in air flow into the brake pipe. This, of course, is one of the two primary functions of the indicator.

Relationship to System Leakage

Laboratory tests conducted by the air brake manufacturers with evenly distributed AAR brake pipe leakages up to 5 p.s.i. per minute but with substantially no system leakage have disclosed that a relationship appears to exist between the indicator reading and the brake pipe gradient on trains of varying lengths. The laboratory tests conducted thus far under the above conditions indicate that the brake pipe conditions during charging, when

the recommended application settings (Light-Off during charging) are reached, closely parallel the attainment of a brake pipe pressure gradient between the locomotive and the rear car of not more than 10 p.s.i.

This relationship under actual service conditions was confirmed to a marked degree by the service trials. The gradients are approximately 10 p.s.i. or less when the indicator reading reduces to the application setting with one exception, and it is suspected that this particular train had rather heavy system leakage as differentiated from the AAR brake pipe leakage.

The data reveals another fact which, if confirmed by further service trials, would be of considerable value in keeping the engineman aware of the degree of charge of the rear end of his train. The time (in minutes) required for the indicator hand to move from 6 to 4 p.s.i. for 24-RL equipment or from 3½ to 1½ p.s.i. for 8-EL equipment seems to indicate very closely the gradient in brake pipe pressure between the engine and caboose expressed in p.s.i.

Even though complete benefits may not yet be fully appreciated, indicators in service have been very beneficial in eliminating (1) the confusion in departure yards which occurs many times where unrecognized brake pipe or brake system leakage exists, and (2) in preventing break-in-twos due either to the engineman failing to recognize a train-initiated brake application or attempting to start a train too quickly following a stop made with full-service or an emergency brake application. Would not the cost of installing a Brake Pipe Flow Indicator be less than the replacement cost of one draw head?

Discussion

One of the frequently overlooked benefits of the brake pipe flow indicator is in yard charging. On one occasion a yard master wanted to change locomotives on a train ready to leave the yard because the locomotive would not charge the train. The trouble was, however, not with the locomotive but with excessive train leakage, which was shown by the flow indicator. This member felt that the brake pipe flow indicator is second only to the feed valve in importance. Another member reported that his road found that the average break-in-two causes a total delay of seven train-hours, including the train on which it occurred and other trains. He said that another advantage of the brake pipe flow indicator would be that it would stop the train crews from opening the conductor's valve slightly in the caboose to keep the brakes on the rear cars to keep slack out. Sounding the whistle on the rear end was reported by one man to cause the brakes to stick on the rear of the train. He said it cost from 120 to 140 dollars to equip a unit with the flow indicator but it would pay for itself hundreds of times in eliminating break-in-twos, coupler failures, stuck brakes, etc.

Standardization of Diesel Brake Equipment

The basic 24RL equipment should be stripped to an equipment comparable to basic 6SL and 6BL equipments. Where added features are desired, it would be up to the railroad to pay for them—any or all—instead of having to pay for all of the features because it was the builders basic equipment, and then removed if not desired. Some railroads have removed certain features and inserted blanking caps, yet the piping remains.

The dead engine fixture should be moved into the cab of all units having 6SL or 6BL brake schedule, and located on or near the brake valve pedestal, with handle for cutting it in or out located in such a manner as to not be easily changed from one position to another by someone using it as a foot rest. In addition, an escutcheon of handle position should be placed on the bracket supporting the dead engine fixture, or on the brake valve if attached thereto.

All cut-out valves should be located on the up stream side of the device it supplies. One builder is locating the NS-1 reducing valve between the main reservoir and the cut-out valve to the control air reservoir. When the NS-1 is to be removed or cleaned, the engine must be stopped, main reservoir equalizing end valve or valves closed, if multiple unit locomotive, then main reservoir drained before the NS-1 valve can be removed. If the cut-out valve is located between the reducing valve and main reservoir in the supply line, closing of the cut-out valve and draining the control reservoir would be all that is necessary before removing the reducing valve.

Automatic drain valves should be applied to all main reservoirs and sumps. The automatic drain valves should be actuated by the governor through the same air line that unloads the compressor.

The horn cut-out cock should be close to the reservoir supplying the air, so in the event of a broken pipe, the loss of air can be immediately stopped by closing the cut-out cock. However, with the cut-out cock located in the engine room, it prevents the sounding of the horn unless the fireman remains in the engine room to operate the cut-out cock when signalled by the engineman. The cut-out cock should be located in the cab, available where its operation would be within reach of the engineman for emergency sounding of the horn if the operating valve became defective, and it would avoid the disturbance of a continuous sounding horn.

Rotair valves should be located in the cab forward of the engineman's position with no lost motion between the handle and valve stem. The objection to locating the rotair valve in the nose of a diesel unit with an extension handle extending into the cab is due to lost motion which causes the indication on the escutcheon plate to differ from the actual position of the rotair valve. On units with dual controls, a three-way cock should be used instead of a double check in the actuating pipe before the pipe enters the rotair valve from either of the independent brake valves to eliminate an extra rotair valve, additional piping and provide for safety.

Piping Arrangements

When laying out piping arrangements for new designs of locomotives, the air brake manufacturers should be consulted to insure that the piping will be such that a stabilizing reservoir will not be necessary. To prevent the necessity of a stabilizing reservoir, the piping should be so arranged that separate branches should be utilized from the main brake pipe to the brake valve and from the main brake pipe to the D24 control valve. Under no circumstances should the "T" leading to the D24 control valve be placed in the line between the brake valve and the main brake pipe.

End pipes should be standard in their location. Reading from the coupler to side of unit, they should be: main reservoir equalizing pipe, actuating pipe, independent application and release pipe and sand pipe. One builder has the location of the actuating pipe and independent application and release pipe at the end of the unit located in reverse postion on freight units to their position on passenger units. This calls for crossing hose when coupling a freight unit to a passenger unit; or if hose not crossed but coupled parallel, the brakes on the trailing units apply to a high brake cylinder valve when the independent brake valve handle is depressed to release an automatic brake application on the locomotive.

The locomotive builders must take great care when locating pipes on locomotives. One located a main reservoir pipe supplying the sander relay valves across the locomotive beneath the frame directly over the front wheels of the front truck. After some time in service, the flanges of the wheels struck and closed this pipe.

Last year certain length hose for coupling air pipes between units were recommended to the AAR Brake and Brake Equipment Committee, yet one builder has, as recent as March 1953, delivered units with hose on the same type unit of different length. Therefore, we wish to renew our recommendations of last year—the need for a uniform piping arrangement on all locomotives, regardless of builder, which will utilize a minimum number of standard hose size. (See table, page 91, *Railway Mechanical* and *Electrical Engineer*, November 1952).

It is understood that all the hose listed will not be used on each diesel unit. The builder should pipe each unit so that which ever hose are used, they will be of the recommended sizes. Only in this way can a standard be established. The piping arrangement must be such as to allow a multiple unit locomotive to negotiate the maximum curvature the locomotive is designed for, without pulling hose coupling apart.

The committee saw no advantage to using armored hose except possibly on the main reservoir equalizing end connection. The other hose are seldom subjected to high pressure and then for

very short time intervals. The committee did recommend the removal of the brake pipe line connection and replacing this armored hose with pipe. This recommendation resulted from study of failures and delays due to the lining of the brake pipe line connection hose collapsing, acting as a check valve, and preventing a brake application or a release of the brakes on a train. One railroad successfully re-piped their locomotives so as to eliminate these line connections.

The report was prepared by a committee of which A. M. Malmgren, Frisco, is chairman.

Discussion

One member did not concur with the recommendation for placing the dead engine fixture in the cab; he thought it would be better to have it out of sight as you still have to go under the cab to make the remaining adjustments for moving a unit dead. Another member said that the more you cover up devices, the less attention they get. One man wondered why the locomotive builders assembled the NS-1 reducing valve as they did with the cut-out cock on the outlet instead of inlet. If taken part it can be reversed without cutting out the main reservoir cut-out cock.

It was felt that there is a definite place for armored hose, such as the brake cylinder connection between the body and the truck, and other places where it is hard to inspect and service and where subject to abrasion. There is less danger to armored hose collapsing than rubber hose bursting en route. The former trouble could be fixed at the end of the trip. Also armored hose generally goes from one annual to the next without attention, without repair, whereas rubber hose may require replacement.

Multiple Capacity Freight Car Brakes

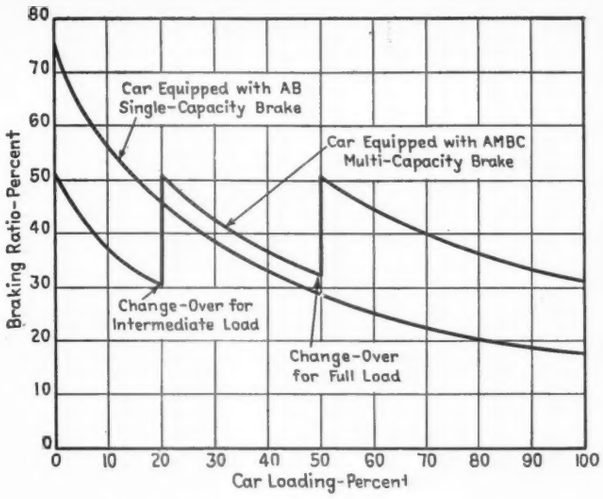
Present AAR recommendations limit the maximum empty braking ratio to 75 per cent and the minimum loaded braking ratio to 18 per cent, so that something more than a single capacity brake is indicated when the gross to tare ratio exceeds 4.17. Many railroads have found it advantageous to go beyond a single capacity brake with much lower gross to tare ratios to improve stopping ability, reduce train shock and increase the margin of safety in grade operation.

It is the purpose of this paper to review briefly the several forms of multiple capacity brake equipments now in use and to cover in more detail the latest development along that line. Only those equipments employing the AB valve will be considered in this discussion.

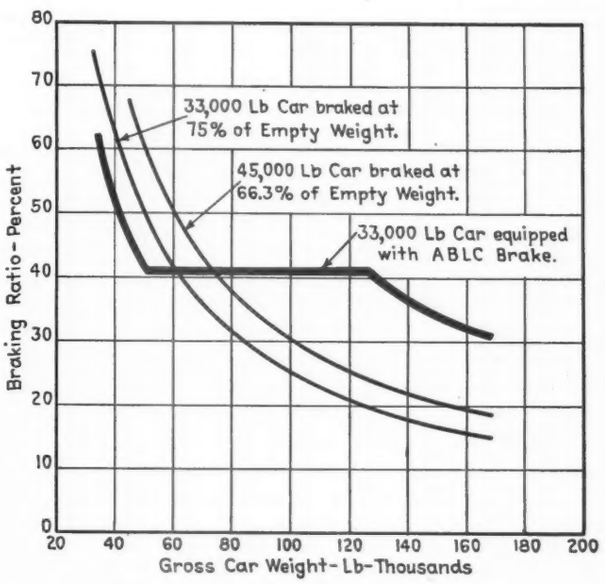
The ABEL-8 in. shown was designed to have the same air consumption as the AB-10 in. single capacity brake, and was intended for use on cars light enough that an 8-in. brake cylinder would provide sufficient empty braking force. Using 60 per cent empty braking ratio, this means a light weight of not over 43,700 lb. when single shoe brakes are used with the recommended leverage limit of 10.5 to 1, and 54,200 lb. when clasp brakes are used with a leverage limit of 13 to 1. Two brake cylinders are used, with the load cylinder size and leverage ratio dependent on the loaded weight and desired load braking ratio.

The ABEL-7-⅝ in. equipment is a modification of the ABEL-8 in. with a single differential brake cylinder substituted for the separate empty and load cylinders. This permits omission of the transfer valve portion of the changeover valve, as well as the empty cylinder volume in the pipe bracket so that it was possible to provide a smaller pipe bracket. Installation is simplified considerably by the use of a single cylinder and a number of these equipments have been applied to cars built recently. The load position area of the differential cylinder is equal to a 12-in. diameter piston, so that for a nominal loaded braking ratio of 30 per cent (27-33 per cent) this equipment is adequate for a 70-ton car with single shoe brakes (10.5 to 1 leverage limit) or a 90-ton car with clasp brakes (13 to 1 leverage limit).

ABEL-10 in. equipment is intended for heavier cars where a 10-in. empty brake cylinder is required. It is a two-cylinder equipment generally similar to the ABEL-8 in., except that additional reservoir volume is required for the load cylinder. This calls for a relay valve portion in the changeover valve. The automatic weighing mechanism is the same as used with the ABEL-8 in. equipment. Many of these equipments are in service on ore cars of heavy construction where single shoe brakes are used and the leverage limited accordingly.



Comparison of braking ratio in relation to load for single- and multi-capacity brakes.



Comparison of AB and ABLC braking ratios—Braking ratio vs. gross car weight.

Special equipment for heavy cars where the gross to tare ratio is such as to require an empty and load brake involves standard AB-10 in. equipment supplying a dummy brake cylinder volume which acts as a pilot to control through a differential relay valve whatever power brake cylinders are required for the car weight and capacity. This relay valve is of the F type used in passenger service and has two values, 100 per cent of the pilot pressure in load position and 40 per cent in empty position. The proper ratio is selected automatically by a changeover valve under control of a strut cylinder just as in the equipments covered previously. Some cars have been built recently by the Southern Pacific with this equipment.

ABLC equipment was developed to meet the demand for a light weight equipment having braking values intermediate between empty and full load. The differential brake cylinder used with the ABEL 7⅝-in. equipment was first developed for the ABLC equipment and thus both equipments are subject to the same car weight and capacity restrictions. The weighing system is more complex than the strut cylinder arrangement used with the empty and load equipments covered previously. The weighing gear is located as close as possible to the truck center to minimize the effect of truck tilting and truck swing, and is attached to

(Continued on page 94.)

Traveling Engineers Talk Diesel Locomotive and Train Operation

R. D. Nicholson, President

L. H. Peters, Sec.-Treas.

Safety, personnel relations and prevention of rough handling stressed in addresses. Two papers only on steam.

THE growing strength of the transportation agencies which compete with the railroads and the necessity of acting to improve the railroad position was repeatedly stressed in the addresses presented at the 1953 annual meeting of the Railway Fuel and Traveling Engineers' Association held at the Hotel Sherman, Chicago, September 14, 15 and 16. Reports dealt with employee training in diesel locomotive operation and fuel economy, both diesel and steam.

Lectures were delivered on the construction and operation of Electro-Motive Division locomotives by E. L. Formento, School Instructor, Electro-Motive Division, General Motors Corporation, and Fairbanks-Morse locomotives by C. H. Morse, Jr., manager, diesel locomotive servicing department, Fairbanks, Morse & Co. Lectures were also delivered on the Vapor steam generator by G. C. Scott, Sr., service assistant to vice-president, Vapor Heating Corporation, and on the Elesco steam generator by C. E. Leet, Superheater Company.

A joint session, attended by members of the Railway Fuel and Traveling Engineers' Association and the Air Brake Association was devoted to train handling. An account of this appears elsewhere in this issue. The papers were on passenger- and freight-train handling, including dynamic braking, by A. M. Malmgren, general diesel and air-brake supervisor, St. Louis-San Francisco, and on slide flat wheels on diesel locomotives, by R. H. Francis, general road foreman equipment, St. Louis-San Francisco. A panel discussion on diesel locomotives, for which 1 hr. 45 min. were allowed on the program, proved of great interest. The panel consisted of representatives of the four diesel locomotive builders. Questions in writing were collected during the first two days of the meeting. Some of the questions submitted could not be answered within the time allowed. These will be submitted to the panel members to whom they were directed and answers will appear in the printed Proceedings. The panel discussion will be the subject of an article in a later issue of *Railway Locomotives and Cars*.

In opening the meeting, the president, R. D. Nicholson, general road foreman of engines, New York, New Haven & Hartford, stressed the fact that the road foreman must meet any situation which arises in day-to-day railroad operation. He must be able to instruct the enginemen as to their duties and explain the functioning of the locomotives they are called on to operate.

Addresses were delivered on safety, on employee relations on the Canadian National, on the traveling engineer, and on loss and damage due to rough handling.

J. J. Brinkworth, in a brief talk at the opening of one of the sessions, said that several hundred more diesels have been placed in service during the past year and more are on order. The diesel has changed railroading, he said. The traveling engineer's job has become extremely important—one requiring great patience—to make diesels perform as intended. The past year's safety record has been good, he said. The railroads are putting in more and better signals. The traveling engineer must keep constantly before his men the necessity of living up to the operating and signal rules.

Businesswise, 1953 has been good to the railroads. But, Mr. Brinkworth said, they are going through the toughest competitive period of their history. Nothing is more important now than good public relations. Rough handling of passenger trains and damage to freight caused by rough handling doesn't make good public relations.

During the next few months, he said, a big managementlabor problem is looming up. Any problem, Mr. Brinkworth, believes, can be solved over the bargaining table if everyone just "keeps his feet on the ground." Road foreman, he said, can exert much influence in this direction. There must be no national railway strike in America, he said.

New Bylaws

During the meeting the members adopted revised bylaws. The principal change is in the method of electing officers. Instead of electing three vice-presidents of equal rank, the new bylaws call for the election of a new third

vice-president, each year and advancing the first-vice-president to president, the second-vice-president to first-vice-president, and the third to second. These nominations are made by the Executive Committee, with provision for other nominations from the floor. The officers for the coming year are listed on page 96.

Abstracts or summaries of the addresses and a selection of the papers presented at the meeting follow.

Diesel Failures and Remedies

The report on Diesel Failures and Remedies contains 20 cases of failures which caused road delays of 15 min. to 3 hr. 40 min. The causes and remedies are stated.

The most frequent single cause of failure is engine not loading, of which six instances were reported. In one case the cause was a metal seal wire fouling a shunt circuit. In another the cause was traced to the control switch in the trailing B unit. Cloth in a starting contactor interlock was the cause in a third. The control air valve was found closed and the reservoir drain cock open in another. An EMD FP-7 unit trailing an E-7 would not load above the fourth throttle position. After two crews had reported the bare failure, the third reported the relation of the failure to the throttle position, enabling the electrician to locate the trouble. The sixth was caused by a failed 80-amp. battery fuse which tested good when removed.

Low batteries were reported in three cases. In one, the 200-amp. auxiliary generator fuse was blown. A delay of 2 hr. 25 min. resulted because the crew did not discover the cause. In another case the low battery was caused by the auxiliary generator field breaker tripping. The engineman of a work train allowed his battery to run down and could not start the engine.

Two cases of defective jumpers were reported. On one the engines of the second and third units of the locomotive were hunting. The fireman changed the jumper. In the other the rear unit reverser was not working, causing a delay of 2 hr. 25 min. to a freight train.

The other nine failures, all from different causes, were due to low oil pressure caused by a dirty oil filter; a tripped generator field circuit breaker on a unit with which the crew was not familiar; a blown battery fuse in the hands of a crew which should have known what to do; an engineman burned by pressing the button on the brake contactor magnet valve, thinking it was a power contactor; fuel pumps stopped on an EMD passenger locomotive, caused by a burned PC switch making poor contact; had to stop for water for the cooling system because the main drain valve was not closed tight; the PC switch was not recovered until both engines on an EMD E-8 unit had stopped for lack of fuel after an emergency brake application; radiator shutters failed to operate automatically, causing a hot engine; one of three units down because loose amphenol on overspeed switch broke the contact.

Some of the failures were the result of poor maintenance, but in many of these cases the amount of time lost could have been reduced had the crews been alert in tracing the source of the trouble.

The report was presented by J. R. Weller, supervisor of locomotive operation, Baltimore & Ohio.

Reduce Rough Handling

By Fred Wilson,

Assistant to chairman, Association of Western Railways

Loss and damage expense from a monetary standpoint is of considerable concern to the operating officers of this country. The bill last year was $107,000,000. That is a lot of money. And yet the shippers tell us that if we paid all claims in full as presented, at the full invoice value, without any compromises, we would fail to make them whole by at least half.

Rail Competition Less Destructive

The shippers have told us that they have about reached the limit on the amount of money that they can afford to put into better packaging and better loading practices. In fact, the traffic manager of one of the industries on the west coast, with national distribution, told me that a test shipment involving an average increased cost to him of about $12 or $13 per car for preparing his load was sufficient to exclude him from a considerable trade territory that he had theretofore enjoyed.

We are no longer a transportation monopoly and I sometimes wonder whether we all recognize the extent to which the competing forms of transportation are cutting into our business. Unfortunately, the competing forms of transportation will take and deliver in usable or salable shape packages that we won't accept in the condition tendered.

Another thing that enters into this picture from an economic standpoint is the amazing growth in the value of the commodities that we have to move. We are handling amazingly valuable commodities that are also very susceptible to substantial or complete loss. Essential oils is one. They are the basic products used in the manufacture of cosmetics. They run up to $12,000 and as high as $16,000 per cask.

Not long ago we had a shipment to Los Angeles in which two drums of essential oils were packaged together with a car of ground vanilla bean meal. One of the casks of essential oils sprung a leak due to overspeed impact. It saturated this vanilla bean meal and the total claim paid was $28,000. That was a good many times the gross revenue on the shipment.

The question is very frequently asked in these joint careful-handling meetings we hold why we don't eliminate rough handling by shoving cars to rest. I asked that question somewhat facetiously in addressing a group of shippers not too long ago and they said that they were interested in two things: they were interested in service, getting their traffic from here to there on the expected schedules, and they were interested in its being in a usable or salable condition, but that of the two, they were more interested in the schedule than they were in the condltion of the package, if it were a choice between the two.

The Road Foreman's Part

Are you not in a position to contribute a share in this effort to bring about better terminal handling by spending more time with the yard engineers? If it is true that the yard engineer is not in a position to receive the signals or doesn't act on them promptly and properly, instruct him.

In answer to the question, "What should I say to this group?" one chief executive said: "Two things. Tell them to talk rules, to know the rules themselves first and, by all means, not to wink at rule violations." He said: "If you see a rule violation and pass it by, you have done a good deal more harm than if you hadn't been around, because in the mind of the engineman you have given your blessing by your silence to what he was doing."

The evidence is coming in pretty conclusively that about 80 per cent of the claim bill is chargeable to damage to freight while in our possession, and a good many estimate that up to 90 per cent of that 80 per cent is due directly to over-speed impacts in yard handling. Now, you can't find any such amount chargeable to rough handling in loss and damage figures. The unlocated damage column is what catches the claim agent's settlement of damages that showed up at destination.

As the immediate supervisors of the enginemen, I am hoping that you will go back home determined that you are going to take more interest in that particular feature of enginemen instruction and supervision than you have heretofore.

Another thing that my adviser said to me when I asked him what I should say to you was that we should not overlook the importance of on-the-ground education, particularly of the younger men. You should assure the new employee, not once but frequently, that it is no disgrace; that it is very much to his credit to ask questions when he needs information. Make them feel easy in the job.

Smoke Abatement

As long as coal-burning steam locomotives are in operation, the railroads are going to be confronted with more and more drastic regulations for the abatement of smoke and cinders, unless they take the initiative and put forth every effort to control this nuisance —not only in districts where smoke emission is regulated by law, but throughout the entire territory as well.

Reasons why railroads should adopt and police their own rules for the regulation and prevention of excess smoke from all coal-burning equipment are:

1—Excess smoke is recognized as a public nuisance. The railroad is a part of the community in which it operates. Therefore, through its employees it should support all civic betterments and thus establish and maintain better public relations.

2—To dispel the idea from the mind of the public that smoke and dirt are natural products of the railroads, and that they (the railroads) are the chief offenders in air pollution, especially smoke.

3—Smoke abatement and fuel conservation go hand in hand. Smoke is the result of incomplete combustion, and only where combustion is brought about under the most favorable conditions there will be no smoke.

Support of Management Required

An effective smoke abatement program *must* have the full and complete support of mangement. The division superintendent and master mechanic, the top ranking supervisors in the operating and mechanical departments on a seniority district must take *active* interest in any program developed. They must see that all subordinate supervisors under their jurisdiction make every effort to educate the employees concerned with the handling of coal-burning equipment, such as enginemen, firemen, hostlers, fire cleaners, fire-up men and fire and water tenders, to become smoke conscious. Only by this active interest can the best results be obtained.

The education of employees is the most important function of all in smoke abatement. Often the supervisor assigned to the task of educating the employee to be smoke conscious has not been sold on the idea himself. That is why I stated previously that better results are obtained when the division superintendent and master mechanic take an active interest in it.

The task of educating hostlers, fire cleaners and fire and water tenders at the enginehouse to clean and maintain fires or build new fires in engines with a minimum of smoke should be assigned to a supervisor who is known to have the necessary qualifications for this work, including a desire to produce results. He should then have the full support of all other supervisors at the engine terminal. The task of training firemen for road and yard work is a duty of the road foreman of engines and his assistants. On some roads traveling firemen or special-duty men are assigned to this work.

More Shovel Firing Required

New firemen on student trips should be with experienced firemen who are capable of imparting their knowledge to the new men. The instructor fireman should explain to the student every move he makes in preparing the locomotive for the trip, and at a convenient time should demonstrate to him how to place coal in the firebox with the scoop. This is becoming a lost art in main-line service. However, due to continued activities in municipalities for smoke abatement, many of which have adopted stringent antismoke ordinances, it is necessary, in order to avoid these complaints, to do more shovel firing in preparing the fire, in approaching restricted smoke zones, or while the locomotive is standing.

As an aid to the reduction of objectionable smoke, locomotives in yard or switching service should be equipped with overfire jets to supply additional air and to create turbulence to the combustion area at times when an insufficient amount is being drawn through the grates and fire bed. A good blower when used judiciously by the fireman, is one of the best devices available to assist him in controlling the emission of smoke from the stack.

The necessity for close supervision of engine crews in the yards is often overlooked. Many shop supervisors have the mistaken idea that an engine working in switching service does not require the same maintenance attention as one in through service. In view of the fact that a very large portion of all objectionable smoke is made in the yards and at terminals, it follows that, to overcome this, locomotives must be maintained in better condition and closer supervision must be given employees.

Smoke produced by coal-burning equipment on the railroads can be controlled to a point where it will not be objectionable if equipment is properly maintained, fuel of a reasonably good quality and preparation is furnished, and supervisors *will not condone unnecessary smoke* at any time.

The report was presented by a committee of which R. G. Norton, supervisor of smoke abatement, Norfolk & Western was chairman.

CNR Takes Employee Relations Seriously

By W. T. Wilson
Assistant Vice-President, Canadian National

We can no longer afford a hit-and-miss method of initial employee recruitment. The railroad is not a one-man show; success is measured by the sum total of coordinated individual efforts and it is astonishing how the bad performance of a single misplaced or maladjusted employee can undo the good work of hundreds of his fellows.

A Uniform Employment Policy

On the Canadian National we have adopted a fairly uniform employment policy. We have not yet covered the whole of the system, but employment offices are located at Quebec City, Montreal, Toronto, Winnipeg, Manitoba, and Edmonton, Alta. Officials of the personnel department are presently in Saskatchewan opening an employment office at Saskatoon and another will be opened before the fall in Vancouver, B.C. These are staff offices. They receive requisitions from all departments of the railway for all classes of help. The employment offices do not hire anyone on their own authority. Considerable progress has been made in the screening of candidates to cut down the turnover and to have regard for the potential he or she may possess for the jobs within the normal line of promotion.

The second step in protecting our investment in our human resources involves proper induction, or introduction, of the new employee to his job and all that goes with it. This is one of the most important phases in the development of the worker. At this time he will be in a most receptive and impressionable frame of mind. The crude and domineering type of reception to which new employees are frequently subjected can readily sour a potentially worthwhile employee from the very start. Negative attitudes are catching, like the measles, and can infect others with whom the employee works.

Why People Get Fired

Recently, a study of why people get fired or quit by Dr. Moore of the Psychological Service Center, Toronto, was published in the Financial Post of Toronto.

Dr. Moore found these significant facts:

1—Nearly 17 per cent of severances arose partially through employees having interests quite opposed to those common to successful employees in a particular field.

2—Only 6 to 7 per cent failed solely because of inability to do the job.

3—Personality factors were repsonsible for 60 to 75 per cent of failures.

Dr. Robert D. Loken of the University of Illinois also recently completed a turnover survey which, like that of Dr. Moore, dis-

closed that 75 per cent of the people covered in his investigation quit their jobs or were fired for reasons other than ability. He also agrees with Dr. Moore that most of the causes were within the power of the employer to correct.

The Desire for Recognition

Wage increases, employee benefits and all the other inducements known will not create job interest, a feeling of security, initiative, good morale or loyalty. Such things do not have a price; they cannot be bought. In their proper sphere inducements are important, but in reality they are only supplementary to the basic human motive which could be summed up as peace of mind and desire for recognition.

Keep workers informed—about themselves and the company. To make employees feel worthwhile, appreciated and part of the railway faimly we must tell them what they want to know. They want general knowledge about the company, its organization and its operation. They want to know about its policies, especially new ones, and how they will affect themselves and their coworkers. They want to know how their work fits into the overall picture of operations. When circumstances necessitate lay-offs, employees want to know the reasons and how they, as individuals, will be affected.

The key to effective communication is held by our supervisors and foremen. We cannot bypass them in reaching our employees; we must work through them. Imparting understanding and encouraging the development of ideas is the responsibility of every supervisor from the president on down.

Problems of Communication

Presidential letters, articles in the company magazine, check stuffers, talks to company educational and recreational associations all have a place in the communication of understanding.

Even more effective, and for which there is no substitute, is the personal contact. This allows an exchange of ideas and questions on a man-to-man basis. This is why the role of the chief clerk and foreman are vitally important.

Keeping employees informed about their performance, as individuals, is not only the responsibility of management, but it is a right that is due every employee. He must be informed as to how he stands and how he is doing. He deserves praise when he does a good job and constructive criticism when he doesn't.

Management Must Listen

The series of articles published a short time ago in Fortune magazine entitled "Are You Listening?" gets very close to what I have in mind concerning communications. Top management will certainly have to listen more in the future than they have done in the past. Middle and lower management for their part will also have to listen to their employees in a similar way.

The old type edict has got to be replaced by more modern means of communication. Committees, group discussions, meetings, explanatory literature, social gatherings, open houses, are just a few of the newer techniques developed. On our railroad we are constantly probing, surveying and experimenting to find which of these techniques are most suitable for our own organization.

[In closing Mr. Wilson described the experimental staff college which the Canadian National set up this year. The students comprised 47 men from several departments, ranking from assistant division superintendent up, who were considered to have promotion potential. This course began on May 17 and was completed July 17. It is hoped that it will justify the development of a staff college operating throughout the year.—Editor]

Instructing Diesel Enginemen

The changeover from steam to diesel locomotives has taken place so rapidly that the problem has been to keep up with the new equipment. Training enginemen in the operation of the different makes of diesel power has taken time and patience both of engineman and instructor. However, be it ever to their credit, enginemen have shown real ability in mastering the diesel locomotive in a very short period of time.

The best assistance the instructor can obtain is to create sufficient interest in the enginemen to get them to study the diesel locomotive and its component parts voluntarily. If possible to obtain, a model for demonstration purposes in the course of instruction will enable the audience to grasp the subject quickly. In teaching enginemen on the road, the instructor must be fully capable to demonstrate by actual performance, otherwise there will be a loss of interest.

Teach and Practice—Safety

The instructor must insist on Safety First and dwell on the importance of conforming with safety rules and practices. Instructors should prove their sincerity by practicing what they teach. Men are quick to recognize sincerity in the matter of safety and equally quick to cooperate. Many times an accident is the responsibility of the supervisor or instructor because he tolerated unsafe practices and conditions.

Enginemen are examined on the operating rules and are furnished with a copy of these rules for their personal reference and study. Enginemen must be impressed with the importance of literally obeying these rules. A chance-taker sooner or later comes to grief. Invariably innocent people suffer.

Make Failure Reports Intelligible

Enginemen should be taught to analyze failures so that they can make an intelligent report of the circumstances. Take a typical report, "Locomotive will not load up." This does not tell the roundhouse foreman or the mechanic what he must do to correct this condition. An excellent rule to follow in making out a work report is to describe briefly the failure and how the locomotive performed.

Locomotive builders have issued schematic drawings and comprehensive literature which cover everything from the operation of the locomotive to a description of the various component parts. The instructor is far from wasting his time when he teaches the enginemen how to read these drawings.

Give Enginemen Circuit Diagrams

The tracing of the wiring diagram of locomotives gives the engineman a first-hand picture of the circuits on a locomotive and is of great benefit to him and others in trouble shooting. When we run into one of our passenger men and we get to talking to him about trouble on the locomotive, the first thing he will do is to pull out a schematic drawing and start tracing a circuit. I insist that we teach our enginemen how to read these drawings and then they can locate the trouble themselves. Without this knowledge it is a hit or miss affair, mostly miss, and smooth efficient operation is not founded on this basis. The Traveling Engineers' Association has the 1952 book on diesel-electric locomotive questions and answers. Our crews keep asking us "Where can we get more information?" That is one place we tell them they can get it.

There is only one answer to the untrained man's problem and the instructor has that answer. Take him to the locomotive, patiently show him what happened and what could have been done under the circumstances. Enginemen who have been properly schooled, who have taken a personal interest in the locomotive builder's literature and who have made a study of the various drawings many times locate trouble before it becomes serious, thus avoiding a failure.

Points Which Need Attention

It is important that enginemen be thoroughly instructed concerning the P C switch, the cooling system, the lubrication system, the air-brake system, air pumps, fuel oil, fuses; especially what tests to make to insure proper operation; what to look for in the inspection of the outside gear of the locomotive; checking wheels for flat spots; checks to determine whether brakes are operating properly on the locomotive, and, last but not least, to see that all circuit breakers are closed.

The steam generator is a vital part of a diesel locomotive in passenger service. Enginemen should be carefully coached regarding its operation so that the most efficiency is obtained, as a failure in the winter time means that patrons of the railroad will suffer from the cold and a failure in the summer results in an air-conditioning failure. Enginemen must be taught to insist upon car-department forces stopping all steam leaks in the train line not only because of the needless waste of heat but because of

the loss of steam generator water and a steam generator without water is a complete failure.

Enginemen should be instructed concerning the short-time rating of the locomotive they are operating. While some makes of diesel locomotives do not have a short-time rating, many locomotives do and the operation of a locomotive beyond this rating may result in considerable damage to traction motors because of overheating.

Sanding devices on diesel locomotives are simple to operate, yet many enginemen lack instruction on the importance of operating them properly. Many men are in the habit of opening and closing sanders on a dry rail, which is a needless waste of sand, and with four-unit diesel locomotive operation the fourth unit is running over four times as much sand as the first unit. Enginemen should be taught to use sand sparingly—only sufficient sand should be applied to the rail to keep the wheels of the locomotive from slipping.

Diesel Train Handling

One of the most serious problems confronting the instructor today—one that was brought to the front by the diesel locomotive—is the long freight train and the fast schedule. Enginemen who have not been properly trained will pull these long trains in two when starting, or will break them in two when stopping. Enginemen can be taught to take slack on any kind of grade with the air brakes. With this slack in the train it can be started one car at a time and, when it is impressed on them to keep the speed low until the last car has started moving, they can be assured that there will be no break in two. Likewise, if the engineman has received the proper instructions, he will be able to handle the train regardless of its length or where the loads and empties are located, without rough handling or damage to the equipment.

Some men grasp training and instructions quicker than others. When a sincere man reacts slowly to training, it calls for patience and understanding. The careless man and the "know-it-all" type should receive the same patient haldling. Sometimes disciplinary action is necessary to bring them in line.

The report was presented by J. S. Swan, supervisor locomotive operation, Louisville & Nashville.

Discussion

A question was raised as to the wisdom of giving each engineman a schematic drawing. On the New York Central, as a matter of safety, the men are instructed to keep out of the high-voltage cabinet. Mr. Swan said that the mechanical engineering department makes copies of the builders' drawings showing each circuit separately and that instruction is given only in one current at a time. The men are in classes of three each. They are given colored crayons and color their own drawings showing the fuel system, the water system, the control system, air brakes, etc. Progressive classes last three months.

On the St. Louis-San Francisco, the men are taught in an instruction car, with aids such as slides and talking pictures. The car is used for instruction of enginemen and shop men.

On the Texas & Pacific, a locomotive unit available at the terminal is used by the instructor. He takes four or five men in a group through the unit, goes over fuses and each group of parts, starts the engine, and runs the locomotive.

On the New York Central, each road foreman checks the items of instruction given to each man on a form. If he believes a man needs further instruction on any item, he circles the check mark. The road has manuals on all types of diesels.

Safety in Railroad Operation

By Homer G. Conner
General Safety Supervisor, Baltimore & Ohio

The willful diregard of instructions, recklessness, violent temper and lack of knowledge or training results in more accidents than do any other causes. Knowing the cause of accidents, it is up to each one of us to do something to reduce them to a minimum. That is why we have safety and operating rules and that is why you and I are duty bound to enforce these rules. It should be repeatedly pointed out to employees that most safety rules stand out as monuments to employees who at one time or another were seriously injured, or perhaps fatally injured, thus the reason for the rules.

The chance taker not only exposes himself to an accident and endangers his own life, but also frequently leads to disaster that causes injuries or the loss of lives to other people. As an example, I recall a few years ago the case where seventeen passengers in a motor bus were killed or seriously injured when a fire occurred while the bus was being fueled. The gasoline-station attendant was a heavy smoker and invariably failed to remove the cigar from his mouth when filling gasoline tanks. This time, there was a severe explosion, resulting in the killing or injuring of the persons in the bus.

Find the Cause and then the Reason

Knowing the cause for most accidents, our big job is to find the reason and then to do something to correct the conditions. Collisions and derailments are the main causes of train accidents. Both are preventable, but the former, with the highly intricate signal devices, are usually the result of human failure. Take, for example, a rear-end collision. Tests are made, the signals operate and are working properly, the brakes also work properly; it is therefore, obvious that the engineman ran by the signals. There is the cause, but what is the reason? Every accident constitutes proof that some hazardous condition or unsafe practice, or both, has gone uncorrected. Each accident, regardless of how minor, should be investigated. Many accidents have happened, resulting in no personal injury, but the next time the same type of accident happened a serious injury resulted. That's why I say all accidents should be investigated (1) for the purpose of ascertaining the cause (2) with the view of preventing a recurrence.

In investigating accidents, the idea of trying to fix blame should be avoided, for where it is allowed to enter into the investigation, an attitude to "cover up" develops which makes it very difficult if not impossible to get all the facts.

Acquaint Men With Known Hazards

The employer is under moral obligation to acquaint his employees with the known hazards of their occupation. This is a long and arduous undertaking at the best and one predestined to failure unless management or management's representatives, such as you gentlemen, go before the men at intervals and earnestly and convincingly bring to their attention the importance of complying with all rules and regulations at all times.

Men will never learn safety unless it is taught to them as part of their daily work. Furthermore, safety instructions should never be academic; they should be concrete, vigorous and practical. The proper selection of employees is important, and many more railroaders are giving it much more attention now than was given a few years ago.

A Good Start for the New Employee

A responsible officer should be designated to go over each Safety Rule with the new employee very carefully to see that he understands their significance. Practical demonstration should also be made of certain types of work. We should not even stop there; we must check and recheck to see that the employee follows the safe practice course.

Educating men to think is paramount. Without thinking we have no plans, and without plans there is certainly confusion. We certainly have a number of accidents as a result of not thinking and, unfortunately, some of our men and some of us do not profit by the mistakes of others. We still seem to think "it cannot happen to me." One of our big jobs is to change this line of thinking.

Conservation of Diesel Fuel Oil

The diesel fuel-oil consumption for 1952 was 63,605,474 barrels. This is an average of 5,300,456 barrels per month. With the increased number of units that have been and will be placed in service before the end of this year, approximately 70,000,000 barrels will be used. It is conservative to state that one quart of each barrel will be wasted. At a national average of 10 cents per gallon, that would amount to $1,750,000.

Waste may be due to lack of experience or negligence by the personnel that handle our fuel. This points to closer supervision.

On most road locomotives the fuel fill openings are level with the top of the fuel tank. The hose nipple and filler connection hold from a pint to a quart of oil. If the tank is completely filled, when the couplings are broken, even if the attendant is careful, that amount of oil is wasted. Consideration should be given to installing fuel fill openings in fuel tanks with a 10- to 15-deg. upward bend which is similar to the Electro-Motive and Alco general purpose locomotives. Then the fueling hose can be completely drained into the tank before disconnecting it.

Dirty fuel-fill sight glasses, lights that do not properly reflect on the sight glass at night and one attendant fueling three or four units at a time are causing fuel tanks to be overflowed. Sight glasses should be kept clean and employees at fueling stations should be required to use flashlights where lighting is not sufficient to see the oil level in the glass. The installation of the glow-rod sight glass would help this condition. Automatic shut-off nozzles will allow one man to fuel several units at a time without overflowing the tanks.

Leveling the female filler connections on the hose or nozzle with a smooth finish similar to the male filler on the locomotive would eliminate damage when the nozzle is held at an angle instead of in line with the filler while making the coupling.

Fueling hoses and connections, fuel-pump pistons, piping and storage tanks should be kept free from leaks at all times.

Don't Idle Excessively

It is estimated that a diesel engine consumed three to five gallons of fuel oil per hour in idle position. Excessive idling of diesel locomotives while laying over at terminals should be avoided whenever possible.

Many railroads use tank-line cars. Many of these cars are only 6,000 to 8,000 gal. capacity. There is always 1 to 2 in. of oil left in a car that cannot be pumped out. Railroads can save much fuel by using their own cars of not less than 10,000 gal. capacity.

The unloading track should be as level as possible and the cars level on the trucks to prevent oil from accumulating in the ends of the car, away from the point of pump suction.

At one fueling station on a southern railroad diesel fuel is unloaded by gravity. No oil is left in the tank cars and the unloading premises are clean and free from waste oil. This is desirable where possible and a lot of fuel oil is saved.

Inspection at Loading Points

Inspectors at diesel fuel suppliers' loading points ceheck the condition of the cars and quality of the oil loaded. If the oil left in the car at the unloading point is clean, it could be retained and credit given for the amount by the supplier. The tempeature of oil being loaded could be taken to insure correct net gallons. All diesel fuel oil is paid for on the basis of volume at 60 deg. F. If a tank car with a shell capacity of 10,197 gal. is loaded with oil at a temperature of 80 deg. F., there would be 101 gal. deducted and the car billed at 10,096 gal. If inspectors are not available, cars should be calibrated and temperatures taken at the final destination.

Operating Conditions Which Waste Fuel

The idea prevails on railroads that use diesel power that there is no way to conserve fuel. Diesel locomotives do unproductive work when pulling trains with great numbers of box-car doors open, when enginemen leave the throttl ein the eighth position with air brakes applied, when switchmen and trainmen do not release hand brakes on cars handled, when dispatchers and operators stop trains unnecessarily, when the mechanics and car inspectors, through carelessness, allow work to get by which will delay or stop a train, when track men and road masters do not take up slow orders promptly and when passenger cars are run out of terminals with defective steam traps and leaking steam conduits because of worn out gaskets or defective heads.

The report was submitted by T. J. Conway, fuel supervisor, Texas & Pacific.

Steam-Locomotive Fuel Comparisons

Savings can be effected by providing properly sized and screened coals in place of the mine run containing a high percentage of slack, which has been the common fuel furnished to steam locomotives for many years. In western Canada in recent years large and important fields of oil have been discovered which have made available to the railways ample supplies of Bunker C oil for use on steam locomotives. In many cases economies can be effected burning Bunker C oil which will rapidly pay for the cost of converting the locomotive from coal to oil.

Several years ago extensive and carefully conducted dynometer-car tests were run in parts of western Canada to determine the increase in efficiency of a locomotive boiler when supplied with screened sized coal, compared with the mine run. In one series of tests using a Mikado type locomotive equipped with a Duplex stoker a representative and average grade of mine-run coal was used on the first test, and on the second test the locomotive was supplied with ¼-in. to 1¾-in. screened and sized fuel.

The use of the sized coal resulted in an increase in boiler efficiency of approximately 23 per cent. A large portion of the increased efficiency was undoubtedly due to the substantial reduction made in stack loss in unconsumed carbon. When using mine-run coal from this particular mine the stack loss was 22.8 per cent, and when using sized coal to 1¾ in. maximum the stack loss was reduced to 5.3 per cent.

A second series of tests was run with another representative grade of coal, using the same engine, and in this case there was an improvement in the efficiency of the boiler of almost 30 per cent when using sized screened coal. The stack loss on mine-run coal was 25.9 per cent as against a stack loss of 8.1 per cent using sized coal.

From the increase in efficiency obtained from such tests we were able to determine the premium which the railways could afford to pay for screened and sized coal and still leave a substantial margin of profit to the railway.

Briquettes in Western Canada

For several years one railway has been using screened sized or biquetted fuel exclusively. Mines which are producing screened and sized coal found themselves with such large quantities of fines on hand because the coal from these particular mines was very soft and friable that they installed briquetting plants. The fuel, when briquetted, showed an increase in efficiency close to 30 per cent over mine-run, and all of their coal could be used.

Tests run using the same engine as used on previous tests showed that with mine-run coal the stack loss was 34.2 per cent as against a stack loss of 4.6 per cent after being briquetted.

On one particular railroad in western Canada the fuel furnished for coal-burning steam locomotives is approximately 75 per cent briquettes and 25 per cent prepared coal.

When briquettes are properly shaped and cooled there is very little loss from pulverising when being handled in transit, and they are an ideal fuel for handling in the coal docks during severe winter weather where coal causes considerable delay due to freezing in the dock at wayside fueling stations.

To those railroads which are committed to the use of coal-burning steam locomotives for several years to come the economics of purchasing properly sized and screened coal is well worth investigating.

Carefully conducted dynamometer-car tests have indicated that an oil-burning steam locomotive in Western Canada will show an increase in efficiency ranging from 15 to 20 per cent, as compared with coal-fired steam locomotives.

It is found that overall thermal efficiencies of a properly drafted and fired oil-burning locomotive, including the superheater, boiler and feedwater heater, ranging from 85 per cent to 90 per cent can be attained. If information is available as to to the efficiencies which are presently being obtained from coal-

fired steam locomotives, it would not be difficult to determine the cost of coal and oil per million B.t.u. and roughly estimate whether or not the use of Bunker C oil as a fuel in any particular territory would be worth investigating.

It has been found that the cost of converting the average coal-burning steam locomotive to oil-burning is around $5.000. The cost will vary, of course, with the size of the locomotive, and the figure quoted is an average cost. Added to the cost of conversion would be the expense of installing storage tanks and pumps for handling the Bunker C oil and the cost of heating where this is found necessary. Roughly, however, such costs are cancelled out by the elimination of coal docks, ash pits, and the staffs required to operate and maintain them.

Due to the variation in grades and lengths of trains handled on various subdivisions, general overall comparisons on a per thousand gross ton-mile basis are not always reliable. On one particular division, however, where there is approximately the same number of coal- and oil-burning steam locomotives operating, it was found that the oil-burning locomotives showed a saving in fuel costs per thousand gross ton-miles of approximately 20 per cent. Under average conditions it has been found that the oil-burning steam locomotive in passenger service will effect a saving in fuel costs of 12 per cent to 16 per cent, as compared with the coal-burning locomotive in similar service. Per yard locomotive-mile, the oil-burning steam locomotive has shown savings in fuel costs of approximately 15 per cent.

The report was submitted by A. O. Scott, regional locomotive fuel supervisor, Canadian National.

The Traveling Engineer

By D. B. Jonks

Executive Operating Vice-President, Chicago, Rock Island & Pacific

The traveling engineer must know as much about maintenance of motive power as any roundhouse foreman. He must know more than the roadmen under his supervision and, in dealing with diesel motive power, must know the limitations of the electrical equipment. He must teach the men under his supervision to avoid the damage to freight and the annoyance to passengers caused by rough handling. He must have the ability to make men understand why and how their jobs should be done and to win their desire to do them right.

A good traveling engineer must not end his responsibility at the locomotive drawbar. He must not tolerate the violation of rules in any department. All officers on a division must pull together. If there is a violation, action must be taken. If you don't take it, you are practically telling the man "we don't mean what we are saying; you don't need to observe this rule."

The traveling engineer can help the roadmaster. Riding over the railroad he sees things that may be wrong with track or structures which, if reported to the proper people, may oftimes avoid serious trouble.

Enginemen must be educated in the class as well as on the road. The traveling engineer must make the classes interesting. Make the men part of the instruction. In a few cases that I have had to do with we have had diesel instruction classes where the men actually were running them; they were even putting on some of the lectures.

You can save the railroad a lot of trouble if you will let the men in on what is going on. You can explain to them why certain policies are being followed; explain to them some of the things that are being done to correct certain conditions; explain to them changes that are being made in cars or in power, or in tracks and yards and other facilities. It makes their job interesting. They feel that in being consulted they are part of the team, and that is the way to improve morale.

There is one thing that the president of a railroad told me that has helped me a lot. He said: "It is much better, when you are giving instructions to say 'What do you think about doing so and so?' than 'This is the way I want it done.'" The question leaves the door open. The man may have some good ideas and he may prevent your making a bad mistake.

One of the big problems now is getting enginemen to take pride in getting their engine in off the road in case of trouble. We have fostered the tendency that a lot of the enginemen have now, of not trying to bring their engine in if they have trouble, by not giving them all the information that they ought to have. If you can get enough information over to them, there is a lot that they can do to bring that engine in, and the more they know, the more pride they take in their job.

Enginemen are pretty highly paid individuals and there is no reason that they shouldn't understand a lot better the machine they are handling. That is the job of you who are supervising them.

All division officers have the same primary job and that is to provide transportation. The transportation officer's main tool is motive power, cars in which to move the traffic, and track on which to move it. If the motive power does not perform properly, the job we are all concerned with is not done; we have failed to perform our mission. The motive power will not perform properly if it is not properly operated and maintained. It is the road foreman's job to see that both are done. This takes a man who can understand both machinery and people. If he is interested in both, he can cause both to produce efficiently.

This handy box which is attached to the traction motor frame bracket on the pinion end with a single bolt permits cleaning the pinion while the commutator is being stoned. The pan, developed by the Frisco at Springfield, contains about three inches of either kerosene or commercial solvent for the cleaning job. The pan resting on top of the motor frame shows the motor side and the two brackets with which the pan is secured to the frame.

LMOA Sessions Draw Record Attendance

S. M. Houston, President

C. M. Lipscomb, Sec.-Treas.

OF THE 3,850 members of the Locomotive Maintenance Officers Association 950 registered for the 1953 meetings at the Hotel Sherman and a daily attendance at individual sessions of between 600 and 700 was not unusual. In spite of the fact that there was no joint meeting with the Electrical Section (which met at Atlantic City this year) there was a substantial attendance of electrical men who were interested primarily in one of the reports on the subject of flashovers and the rewiring of diesel-electric locomotives. That part of the report, on flashovers, appeared in the October issue of *Railway Locomotives and Cars* (page 76) and the rewiring section appears on page 106 in this issue.

Addresses at this year's meeting were made by D. S. Neuhart, general superintendent motive power and machinery, Union Pacific; E. L. Duggan, superintendent safety, Santa Fe System; A. C. Melanson, chief, motive power and car equipment, Canadian National and Allyn C. Breed, assistant director, Bureau of Locomotive Inspection, I.C.C. A summary of Mr. Breed's remarks appear in this issue.

The formal reports presented were as follows: Inspection and Maintenance of diesel wheels, axles and roller bearings; personnel training for diesel work; Flashovers and the rewiring of locomotives; shop planning; engine lubrication and a report on the reclamation of locomotive parts. The report on flashovers and on shop planning appeared in the October issue (pages 76 and 53) and the others, with the exception of the reclamation report, appear in this issue.

The officers, executive committee members and advisory board members elected to serve for the coming year appear on page 95.

Watch the Repeaters!

By Allyn C. Breed
Assistant director, Bureau of Locomotive Inspection, I.C.C.

Last year E. H. Davidson, former Director of the Bureau of Locomotive Inspection, in an address before this Association, tried to impress upon you the most important aspect of a safety program.

He described an accident in which the enginehouse force failed properly to complete the job of fitting a locomotive wrist pin. The engine was dispatched without the wrist pin nuts having been tightened. The pin worked out. The main rod dropped down and three men were killed in the wreck.

Last year there was a similar accident on a western railroad in which improper repairs to a wrist pin resulted in the wreck of a double-header freight train in which the engineer and fireman on the second engine were killed and the engineer and fireman on the lead engine and the front brakeman were seriously injured.

While these cases stand out due to the loss of life and damage to be paid for, the principle involved is that someone did not do his part. That is the reason it is neccessary for officers of the railroad to provide a system of inspection and repairs and supervision that will correct mistakes before they become accidents, whether the mistakes be man failure, material or procedure. This applies to all locomotives; steam, diesel-electric or any other type. The number of reports that come to our attention showing what is termed "repeat items," that it, the same defect reported on the daily inspection reports and shown repaired, from 2 to 50 times. The common repeat items which were the usual report on the old steam locomotives, "Caulk leaks in firebox," have been changed to "Clean oil off engine room floor."

On the diesel, oil leaks are a common occurrence. Sometimes the oil leaks are so bad and numerous our inspectors order the unit from service. When the oil leak is adjacent to the generator fly wheel or some other moving part, the oil is sprayed throughout the compartment and a serious fire hazard results. Like the correction for the leaky boiler, we hope some time to correct the condition and are observing tests of various procedures to that end.

In the transition from steam to diesel a situation has developed as a result of the practice by some railroads of coupling dissimilar units to make up locomotives for use in road service.

Locomotive inspection Rule 201(a) reads, "A locomotive may consist of one or more units. The term 'unit' as used in these rules and instructions means the least number of wheel bases together with superstructures capable of independent propulsion, but not necessarily equipped with an independent control."

That rule has been in effect since 1924. No serious problem of operation was encountered with electric locomotives deriving power from an outside source or when several diesel-electric locomotive units of the same general type are coupled. When different types of diesel-electric units are coupled in multiple to comprise a locomotive controlled from the lead unit, complications arise due to the fact that in many instances the engineer does not have complete control of all functions of the trailing units. We do not care to construe this to mean that the engines

in all units must be started from the lead unit, but we believe it essential that all engines may be *stopped* from the leading cab in event of emergency such as impending collision or outbreak of fire. We have numerous cases on record where the fire departments of towns along the line have been called to extinguish fires on diesel locomotives which were beyond fire control facilities available to the engine crew.

It is expected that both independent and automatic brakes on all units shall be uniformly controlled from the cab of the lead unit and that sanding apparatus also be so controlled. Difficulties have also been experienced because of excessive and dangerous variations of height of passageways when units of widely different design are coupled for multiple operation.

I might also give a word of warning concerning a condition which may be somewhat beyond the control of the members of this Association. Coupling units of dis-similar type for multiple unit operation is very liable to cause damage because of different size gears, wheels and operating characteristics. While this procedure is under the general jurisdiction of the operating department, the members of this Association can undoubtedly exert considerable influence to establish an operating principle that only similar type units should be coupled to form a locomotive. By so doing safety will be promoted, maintenance expense reduced and your jobs made easier.

[Note: Since these remarks were made the I. C. C. (Ex Parte 179) has had under consideration the matter of rules for inspection of multiple-unit cars. Action has been taken to revise the Rules for Other-Than-Steam Locomotives. Letters have been sent to all participating parties of record in Ex Parte 179, asking if they would consent to broaden the scope of the issues under Ex Parte 179 to include the proposed revised Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam. This is the first proposed revision of the rules since the advent of the diesel-electric locomotive.—EDITOR]

Inspecting Diesel Wheels

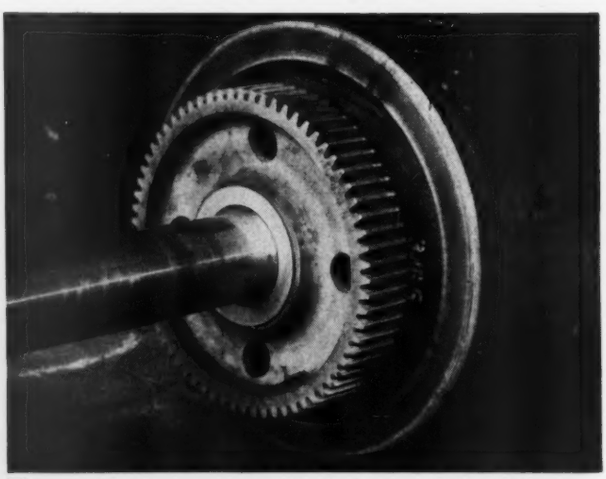
The inspection of the diesel wheels should first start at the mill. Wheels should be delivered to the railroads with the mill scale removed because it is impossible properly to inspect a wheel until the mill scale is removed. Many railroads are either sandblasting or shot blasting the mill scale from the entire wheel and then Magnagloing the surface of the wheels. By the Magnaglo process, new wheels have been found containing roll laps which looked like cracks and which could start progressive fractures. These could not be detected by any inspection method except Magnaglo after removal of mill scale. They could not be detected by the Magnaflux process.

When wheels are removed for turning there are several methods being used to detect flaws or cracks in wheels. One method—whiting and kerosene. Wheels are thoroughly cleaned either by steam with mineral spirits and the parts are then swabbed with kerosene.

The wheels, axle and gear as removed from the switcher.

The same parts after having passed through the degreaser.

One of the wheels, portion of the axle and gear as removed from the switcher but from a much closer vantage point.



The same parts from same point after having passed through degreaser.

A thin mixture of water and Spanish whiting is then sprayed on the plate of the wheel. After the whiting has dried sufficiently, the wheel is vibrated by striking it with a hammer.

Another method used is the Dy-Chek method which is composed of a surface cleaner and dye remover containing chlorinated hydrocarbons. A dye penetrant having a flash point of 130 deg. F. A dye developer having a fire point below room temperature. All of these compounds are volatile.

I. C. C. Inspectors are beginning to tighten up perceptibly in their work, and they are paying more attention to the cleanliness of equipment. The work of keeping a diesel clean is a slow, laborious, and almost impossible task. Several railroads have been concentrating on trucks, wheels, axles, gears, etc., having in mind current instructions provide that wheel plates and gears on diesel locomotives shall be thoroughly cleaned, white-coated and vibrated and the gear Magnafluxed in order to develop flaws, etc.

Many electrical shops contain a degreaser and in view of the effective manner in which grease and the accumulation of dirt, etc., was being removed, one railroad experimentally tried to clean a pair of wheels from a switcher using degreaser equipment—an operation that was not too thoroughly nor successfully performed in eight manhours using conventional methods. The degreaser installed at the shop in question was too short to permit handling both wheels at the same time, therefore, just one of the wheels was placed in the unit at a time. Experiments indicated five minutes in the degreaser for each half was ample to produce a perfect cleaning job, or a total of 10 minutes for both wheels and its appurtenances including axle, gears, etc.

After having passed through the degreaser it was simply necessary to blow off the parts in question by air pressure which were then placed in position for Magnagloing wheel plates, axles and gear with a special prong arrangement. The wheel was placed in the machine in the diesel shop and Magnagloed all over. One crack was developed in the root of a gear tooth.

It was the recommendation of this committee that consideration be given to the installation of proper size degreasers, particularly at points where wheels are handled with emphasis at terminals where wheels are being removed for turning. Tests indicate that such moves will simplify the cleaning of wheels, axles and gears, and probably further experiments will develop ways and means for cleaning entire trucks without incurring the cost of completely dismantling and re-assembling.

The surface of the plate and tread of the wheel has to be absolutely clean. The wheel should be sand or shot blasted, ground or machined for best results. After the wheel has been cleaned, the Dy-Chek surface cleaner is applied and then wiped off, removing any traces of dirt on the surface. The dye penetrant is applied with a brush and allowed to dry. After the penetrant has dried, the dye remover is again used to clean all traces of the dye from the surface. After the surface is cleaned again, the developer is applied and allowed to dry. When the developer has dried on the surface, if any cracks are present, the red dye is absorbed by the developer and the indications begin to appear.

This was part of a report of the LMOA Shop Practice Committee prepared under the chairmanship of C. H. Spence, B&O.

The Lubrication of Diesel Engines

In the early stages of lubricating oil, the only function expected of the oil was the reduction of friction and wear between moving parts. In contrast to this initial requirement the present day oil must not only perform the primary function of preventing friction and wear but must also act as a heat transfer medium, as a protection against rust or foreign corroding agents, as a scavenging medium for all types of contaminants, and as a sealing medium. When a railroad selects an oil, this customer wants an oil to meet the requirements of severity of service; perform satisfactorily over a wide temperature range; protect the engine against a variety of corrosive elements and the products of engine combustion.

It is generally accepted that oil and water do not mix, yet it is on record that the first diesel engine in this country over fifty years ago operated with a mixture of oil and water in the crankcase. The crankcase was filled with water up to the lower level of connecting rod travel and about 2" of oil added on top. There are no records to indicate how successfully this engine operated but actually the water, which quickly formed an emulsion with the oil acted as a cooling medium by its evaporation. Water in the lube oil is today one of the curses of diesel engine operation and one which confronts all railroads.

For most diesel engines, with reasonably good fuel, a properly refined mineral oil best fulfills the requirements of a stable fluid to keep surfaces apart, remain stable under changing temperature conditions, keep lubricated parts clean and not corrode metallic surfaces. There are, however, at least three good reasons to support the use of additive oils, as follows: 1. Increased horsepower. 2. Poorer grades of fuel. 3. Poor maintenance. Increased horsepower means more contaminants from combustion as well as greater bearing loads and higher operating temperatures. As high quality crude reserves are gradually being depleted, it became apparent that fuels of 0.5 per cent to 1 per cent sulphur content would become common. High sulphur fuels cause rapid engine wear and heavy deposits by formation of sulphuric acid during combustion. Poor maintenance manifests itself in dirty engines, plugged oil coolers and lines. A properly controlled filter change program and periodic checks of viscosity together with blotter tests of the lube oil is cheap insurance.

The Electron Microscope

Since fuel oil, as well as the lubricating oil, has a direct bearing on engine operation, comment on the work being done with the electron-microscope is in order. This instrument has opened a new field of study of lubricating and fuel oils. It is the theory of those making this study that fuel oils no longer appear as true solutions and if the dispersant properties of the fuel oil can be controlled by introducing an additive in the heretofore unstable fuel oil that this fuel will burn satisfactorily in the diesel engine. If this theory proves correct, then the railroads will be able to buy cheaper fuel without sacrificing engine performance. The present goal of builders as well as operators of diesel engines is to use the cheap Bunker C fuel. It is toward this end that these studies with the electron-microscope are being persued.

Another possible answer to the use of Bunker C fuel is "Vapor Phasing" of the engine. This system is not new but so far has been confined to stationary engine operation. In a Vapor Phase cooling system, the engine operates with the cooling water at the boiling point. Discharge water and steam are passed into a Vapor Phase Unit where the steam is condensed into water and returned through the pump to the engine jacket. The cooling system is a closed system operating under low pressure and on installations where it has been found necessary to cool the condensing coils, it is accomplished by means of a steam turbine driven fan, power for which is taken from the steam on the water outlet side of the engine. With the elimination of the conventional cooling system and the water outlet temperature being maintained at the boiling point, it is no longer possible to cool must then be used but by operating at this high temperature, sludge and injurious acids caused by condensation and by products of combustion are eliminated. The demand upon the lubricating oil to remove these products is therefore greatly reduced. Consideration is now being given by a Midwestern Road to equipping a diesel locomotive with such a system and when this is done, it will be followed with considerable interest.

A great deal has been said about additives. I wonder how many railroad people outside of their respective test departments understand what additives are, and what they accomplish when added to a lubricating oil. For those not well versed on the subject of additives, here are some of the most common, together with the purpose of each. These are generally organic compounds containing one or more metallic elements: *Oxidation inhibitors,* to resist chemical changes in the oil which occur during engine operation to form destructive acids; *Corrosion preventatives* to prevent corrosive action on alloy bearings and other metal parts of the engine by forming a protective film on the metal parts thru which corrosive acids cannot pass; *Detergents* to keep engine surfaces clean and prevent deposits of sludge; *Dispersants* to keep potential sludge forming insolubles in suspension to prevent their depositing on engine parts; *Rust Preventatives,* to prevent rust in new or overhauled engines during storage or shipment; *Pour point depressants,* to lower pour point of lube oil; *Viscosity Index Improvers* to lower the rate of change of viscosity with temperature; *Foam inhibitors,* to prevent formation of stable foam. While these additive oils have brought about an improvement to some of the ills in engine operation such oils have by no means been a cure-all for all problems. One western railroad experienced serious trouble as a result of bearing corrosion in two types of their diesel engines as a result of the use of improper heavy duty oil. With the widespread use of copper lead bearings with lead either in pure form or as an alloy, deterioration of the lead through chemical action often occurs with some heavy duty oils. The lead is easily dissolved by some of

the lower molecular weight organic acids which result from oil oxidation and bearings containing pure lead are more easily corroded than those having lead as an alloy of other metals. Silver is non-corrodible except by certain types of additives yet the silver-plated wrist pin bushing in the EMD engine must be considered when choosing a lubricating oil.

Another important fact in bearing corrosion is that the corrosive ability of most additive oil is increased considerably when small amounts of water are mixed with oil.

Another case of serious difficulty and finally traced to the use of improper lubricating oil was experienced on several roads. An epidemic of cracked pistons developed as a result of a carbon build-up under the crown of the piston preventing proper heat transfer. The trouble was finally corrected by changing to a different type oil.

There is one item which we cannot deny and that is an engine using a heavy duty oil is generally cleaner than one using a straight mineral base oil. This is evidenced during the tear down at the engine overhaul periods. In order to use the mineral base oil, there are three essential controls which must be followed if your operation is to be successful with this oil: (1) A system wide check for water in the lube oil. (2) Rigid filter maintenance and (3) Viscosity checks, made periodically to determine the extent of dilution or any large increase above the normal viscosity reading.

In a survey of various railroads it was found that many are governed by laboratory analysis to determine both the filter change and complete oil change period. One road, for example, with 1,450 units spread out over 13,000 miles of railroad lacked the extensive laboratory facilities necessary to control this item. Then too, the time element was involved as oftentimes an engine in distress could be miles away from the terminal before the results of analysis were known. Further, some roads are still making lube oil changes at prescribed mileages generally based upon the manufacturer's recommendations.

Many railroads are now using spectrographic analysis as the governing factor in lube oil changes as well as certain engine inspections. By this means the quantity of various metals in the lube oil are measured and the result used as indicative of engine wear. Excessive iron indicates ring or liner wear, excessive copper and lead indicate bearing wear, excessive chromium indicates the presence of water if chromate treatment is used or liner wear if the liners are chrome plated, and excessive silicon indicates dirt or sand in the engine which oftentimes reflects on the air filter maintenance. While no definite base line for the amount of these metals to be expected in the lube oil has been established, it is the sudden increase over what has normally been found in previous samples that is interpreted as abnormal operation and prompts an engine inspection. The inital cost of this instrument is quite high and the results of various analysts inspecting the same sample are inconsistent. A more consistantly accurate means of oil analysis is the X-ray refraction method which when further developed to measure the lighter elements such as aluminum and silicon may well replace the spectograph for this type of work.

More and more roads are reclaiming their lube oil. Heretofore crankcase drainings were thrown away but the economy to be realized by reclaiming has made this process attractive. Exhaustive tests as well as extensive usage of reclaimed oils has failed to indicate any loss in the inherent properties of the lubricating oil. Reclaiming does, however, remove the additives and if they are not refortified the result is a straight mineral oil. One road reclaimed a total of 345,000 gallons in 1952 at a cost of 12 cents a gallon = a total of $41,400. Those roads that refortify reclaimed oil are paying more. The price is about 22 cents per gallon as against 12 cents per gallon where no additive is applied. There is some loss in the reclaiming process which amounts to approximately 27 per cent for heavy duty oils and 25 per cent for mineral oils. However, there need be no separation of the types of oil before reclaiming and they may be collected in a common tank. From these figures a gallon of reclaimed heavy duty oil will cost 30 cents as compared to about 56 cents for new oil. A gallon of straight mineral oil will cost 16 cents as against 48 cents for new mineral oil. The saving is evident.

How About Compatibility?

This brings us to the subject of compatibility. This subject is still clouded with uncertainties and yet the mixing of oils is a necessity on a railroad with a large fleet of diesels using several brands of oil. In all the discussion I have read and heard, the many explanations seem to fall in a set pattern. Namely, the engine manufacturer argues against mixing of lubricating oil, generally the oil company that already has a railroad's business argues along the same lines; however, the oil company when seeking the business says that oil can be mixed with no disastrous results and even recommends it under some condition. The problem is not only one of convenience but also one of economy.

The railroads have many points at which oil is stored and often there is but one storage tank. Their diesels operate over long distances and traffic requirements are continually changing. Even when every reasonable effort is made to prevent mixing of oils, it is impossible to insure that a given locomotive will always be supplied with a particular type of oil. Where railroads are able to confine certain locomotives to certain divisions, they might assign different oils to each division but even then it is questionable whether they could prevent mixing. At some maintenance points, they are required to handle as many as four types of lubricating oils and expected to keep them separated and applied to four different classes of locomotives. As long as the human element is involved and regardless of the many signs hung around the shop outlining what oil for what engine and the color scheme used on the piping and barrels, you will still have mixing of oils. I hardly think any railroad will be willing to expand its lube oil handling facilities by four in order to keep the different oils separated nor do I anticipate any locomotive being held out of service because the right brand of lubricating oil is not available in that particular territory.

It is agreed that, generally speaking, mineral oils are inherently compatible. They form the base stock of all oils used today in the diesel engine. If there is any incompatibility, it must come from the additives which the oil companies incorporate in their products. Fundamentally, two types which are important—detergents and the oxidation inhibitors. The detergents are essentially metallo-organic compounds which include certain metals such as barium, calcium, tin, zinc, etc. In a paper before the New York Railroad Club by a representative of a major oil company, appears a very enlightening statement: "There are virtually no detergents which we have examined in recent years in our laboratories which are not reasonably compatible one with the other."

The second class of additives are the oxidation inhibitors. These compounds generally contain sulphur or phosphorous which react with some organic molecules to keep the acid content down. They will also act as anti-corrosives by actually providing a protective coating on the metal. The oil companies know that there is some incompatibility between the inhibitors and the detergents when they compound their oils, yet this problem is worked out by proper balance in proportions to the chemical nature of the two, thereby overcoming the inherent incompatibilty.

The committee does not advocate indiscriminate mixing of oils as the engine is the one to be satisfied with the mixture regardless of the results of the laboratory analysis. Most of you have facilities at your disposal to detect incompatibility. Furthermore, the bulk of the additives are similar and, therefore, there should be no reason why these additives cannot be standardized thereby removing any question as to their compatibility.

The report was presented by a committee of which J. W. Luke, general supervisor of diesel engines, Santa Fe, was chairman.

Discussion

Comment from the floor of the meeting on this report, like others in LMOA sessions this year, took the form of previously prepared questions with answers from members of the committee. Some of the more pertinent of these are included here:

Q.—If the oil is not changed on a periodic basis, how is the acid present in crankcases removed or rendered harmless?

A.—If you are continually adding new oil over a period of about two months you have completely replaced the original oil and, while there is some breakdown it is felt that it is not necessary to change the oil completely every three months, or on some prescribed mileage basis. One road changes oil at annual inspection periods, in some cases because it is contaminated by mechanics, and not because it has lost its lubrication properties or its usefulness.

Q.—Even if oil is added, how is the acid removed—is it burned off or removed through filtration?

A.—The acid is in solution and it will be lost, to a certain extent when oil is replaced or changed.

Q.—How often should lube oil filters be changed?

A.—On passenger service about 8,000 miles which allows a margin of safety. If reliable supervisory manpower is available to check each engine as it reaches a servicing point the mileage could be increased but the mileage has to be established to catch the bad engines, such as those that are turned around and make abnormal mileages.

Q.—In the mixing of heavy duty oils is the mixing done in storage tanks, or when made up?

A.—After preliminary tests (one railroad representative reported) and agreement by oil suppliers that certain oils from different sources of supply were compatible mixtures of two, three and four oils were tried out by running 150,000 miles in freight service. Inspections and measurements were made at the start of the tests and regular inspections were made by pulling pilot cylinders and examining interiors, top decks and recording the measurements at intervals. The assembly was put back in service. At the end of the 150,000-mile test no trouble was found. At first, oils were mixed proportionately but it was a problem so that at present, in one district, all brands are mixed proportionately while at other points mixing is by groups, in tank car lots, dumped into storage supply. Brands are rotated so that about the same result is attained as by proportional mixing.

Q.—What about the problem of stuck injectors

A.—In two years, one road reported, 837 injectors were sent to the shop for overhauling at a cost of $18.61 apiece. That is one and a fraction injectors a day, indicating an injector life of something more than six years. On that road the injectors represent an investment of $350,000 and it is just as important to protect that investment as that in the rest of the engine.

Training Diesel Personnel

Before attempting to set up any method of training, it must be recognized that no two railroads have precisely the same problem. Each road should make an analysis of its own particular problems. This analysis should reveal the actual ability of both supervisory and working personnel with respect to maintenance of the diesel locomotive. From this analysis methods can be set up to supplement partial training, to correct erroneous practice, as well as to train new personnel.

The effectiveness of the method of training selected will depend upon a proper approach to the personnel to be trained. A descriptive "travelogue" should be given him of where he is going in the days, months, or years of the training process. This approach will have the effect of dispelling fear, implanting confidence, and initiative with a *desire to know*, which is most essential to knowledge. No greater contribution can be made to his training than first to preface the scope of that training.

This can be best shown by a graphic description of the diesel-electric locomotive. Set forth just what this unit of power is (an internal combustion engine, electric generator, electrical transmission, and electric traction motors, producing tractive force). This overall picture is the necessary foundation of all training methods, and will allow for each man to begin with his present level of knowledge and experience.

Supervisors or Instructors

The absence of fear and the desire to know are not sufficient to guarantee the success of a training program. One of the most difficult facts which we face today is that men, even officers and supervisors, frequently profess to have a thorough knowledge of a phase of work. Yet upon close or forced examination, they reveal a dangerous lack of knowledge of the subject, which they attempt to conceal either through shame or pride. Extreme care must be exercised to determine the knowledge of the supervisors, many of whom were brought over from steam supervision. No man should be embarassed to admit that he does not know. Nevertheless, this is a weakness which will wreck any training program. Regardless of what this paper, or any paper, has pointed out with respect to the supervisor, he is the key man in imparting information, through methods, to the personnel being trained, and *he*, himself, *must* first *know*. The railroads must face this fact; the blind cannot lead the blind. Therefore, the supervisor must be thoroughly versed in the objective to be attained, as well as the method to be employed in reaching it. The method is a combination of experience on the job plus technical training that leads the trainee in a progressive sequence from fundamentals to advanced knowledge.

Suggested Outline of Methods

SELECTION OF TRAINED SUPERVISORS

(a) Whenever possible, new supervisory personnel should be selected on the basis of his knowledge of the diesel-electric locomotive as well as leadership qualities.

ANALYSIS OF SUPERVISION PRESENTLY EMPLOYED

(a) Determine actual knowledge of the locomotive with respect to training and supervising others.

(b) Provide supplementary training if necessary aptitude and willingness is present.

SUGGESTED TRAINING PROCEDURES

(a) Builder's Schools.

(b) Supplementary Education. (Correspondence and Vocational Schools, Diesel Club.)

(c) Individual Study of text books and literature. (Operating Manuals, Repair Manuals, Parts Books, Schematic Diagrams, Section Drawings, Etc.)

(d) Class Room Instruction. (Use of classified material in #C; slides, motion pictures, etc., by the instructor.)

(e) Instruction Cars. (Using approximately same material as #D.)

(f) On-the-Job Training. (Personal supervision of the employee while the job at hand is being performed.)

Conclusion

Survey of actual prevailing conditions plus the provision of method to meet the conditions revealed.

Set up system to evaluate the results of methods used to insure that personnel are being adequately trained. Such examinations might be either oral or written to determine whether the personnel are qualified to perform the maintenance of diesel-electric locomotive.

This report was a presentation of a committee of which E. V. Myers, StLSW, was chairman.

Discussion

The discussion of the personnel training report took the form of a number of questions and answers, some of which are included here:

Q.—How do we train a supervisor to know—on a diesel locomotive—air brakes, electrical equipment, engine, governors, running gears, steam generators and body construction? This man will carry the title of diesel foreman.

A.—A good many years ago I heard it said that if you want to raise a good son, start with his grandfather, but that doesn't answer this question.

It would be assumed, first, that a supervisor would, of necessity, have some of that training already, or he wouldn't have been made a supervisor. I'm sure that any railroad company would consider his ability first, before making a supervisor out of him. Now, if it's a railroad that is dieselizing, and they haven't had the opportunity to brief him on the necessary information he needs in the operation of this machine, certainly he needs additional information. It would seem that if you were thinking about going over from steam to diesel, there would be very little change.

Of course, electrical controls and electrical circuits, the principle of generators and motors, certainly mean a tremendous undertaking for a supervisor if he has never had any training along that line. Most railroads have sent their supervisors to builders' schools.

Now, it certainly would be a fallacy to term a man a supervisor who didn't know those things, so some method should be undertaken to educate them. I would suggest that possibly the builders' schools would be the first, or instruction in their own system by qualified electrical supervisors. That is what we are doing today. We have a man who is a graduate electrical engineer who takes time to sit down and give classwork on this subject, and continues to drill our supervisors on the things they need to know about the electrical features of the diesel locomotive.

I would assume that he would already be qualified in a large amount of the work before he was made a diesel supervisor.

Q.—What do you do if a machinists' organization decides that the men do not want to attend the school car without being paid?

A.—One of the things that always confronts a committee is the contractual phase of the crafts. That is one thing the paper doesn't say anything about, but many roads find it can be done in different ways. I would like to suggest that the best way and the *most effective way is to train people who want to be trained.*

In the report we have said that the first and most important asset for the acquisition of knowledge is a willingness and a desire to know. It takes midnight oil in any business.

The railroads should do all they can to sell their working personnel—mechanics and electricians—on the idea of attending classes. If a course is set at a terminal, I would be disappointed if my people didn't go down there to attend classes, and I think you would. If I had people who didn't want to go, well, I'm not saying that you can force them to go, and it would be a little out of place to suggest that you make them go. I don't think I can do that, but I do believe that if your supervision is alert, men can be sold on the idea of attending the instruction car at times other than during their tour of duty.

Q.—In the future training of supervisors to handle strictly mechanical jobs, maintaining 50 or more units, do you consider that an attempt should be made to teach one man, or should additional or duplicate supervision be provided, so that the foreman or the immediate supervisor will be a specialist in his field?

A.—Volume has a lot to do with whether you select one man who has ability to supervise the work of all crafts, or whether or not there is sufficient volume of work of the several crafts that you can divide the supervision and let each supervisor look after his particular craft.

If you maintain 50 units at one point, possibly you might be able to have an electrical man trained electrically and another man trained mechanically, and divide the work up accordingly.

The answer to the question has to do with the amount of volume. It would not be economical to place different supervisors—because of their special backgrounds and early training, basically—over small numbers of men.

Q.—What is the most effective way for supervisors not directly connected with the work to keep posted on changes?

A.—If you are a mechanic, and you have been basically trained, there is not so much needed to supplement the final touches that you need in the mastering of the diesel locomotive itself. Good books, builders' manuals, maintenance manuals, current publications that are appearing in many of our journals, and all kinds of information are available. If you will avail yourselves of them, you can keep abreast of current changes, and should the opportunity come to take over the supervision of a diesel locomotive shop you should be in a position to handle it.

This responsibility is sometimes overlooked by supervisors; they may wait until the morning that they take over to begin to study. You'd better start it yesterday, or a few months back. Keep abreast with the changes of the times.

Q.—Has consideration been given to an adequate means of determining the effectiveness of an educational program? In other words determining whether you are aiming the program at the proper level to get full and complete acceptance.

A.—(by Mr. Myers) The builders have done a wonderful job in giving information to the railroad companies. I am a graduate of one of the early builders' schools, and I'll tell you this, they kind of fed it to me a little fast up there.

We have found that we can revise into lesson sheets the elementary principles that will enable working personnel and supervision more accurately to interpret schematic drawings by breaking them down into simplified forms.

At the beginning it was distrubing to find that we had men in charge of forms who could not read a schematic diagram. We might just as well admit it.

Do not try to make electrical engineers out of supervisors, because it's not necessary, but do try—and try hard—to give them the fundamental teaching that will enable them, for instance, to read a schematic diagram as well as they can read a road map.

Q.—Do you advise training personnel to specialize in certain phases of diesel work or should mechanics and electricians be given general training?

A.—That is a debatable question, and a ticklish question. It is highly desirable that supervisors understand both, but I think you will be found in some respect, contractually, to some of the work, except at intermediate points. As far as training apprentices, if you are bound contractually, it will be a little difficult, but if you are going to make a supervisor out of a man it is highly desirable to see to it that he knows a little bit about both.

I think the answer will depend upon whether you are contractually bound. If your railroad is fortunate enough to be working without those things, do as you please, and then train them all the way through.

Defects in Diesel Wheels

Diesel wheel failures are of three principal types: (1) Shattered rims of the "oyster shell" type; (2) Circumferential cracking through plate at junction of plate and rim fillet; (3) Failures resulting from thermal cracking.

The shattered rim failure, which has been appropriately called the "oyster shell" type due to its characteristic appearance resembling the outside of an oyster shell, has occurred occasionally during the past several years. The seriousness of this type of failure to any individual railroad is dependent to a great extent upon the type of service and terrain over which that railroad operates.

Failure has been predominantly with three types of diesel wheels—A 40, C 42 and F 36. Both driver and idler wheels have been involved, although drivers predominate. Only a few failures have been involved on diesels with six-wheel trucks. No particular wheel position has been significantly involved more than any other. Diesel wheels in passenger service have failed more frequently than those in freight service.

Hardness tests made on failed wheels have not disclosed any deficiency or abnormal variation in hardness.

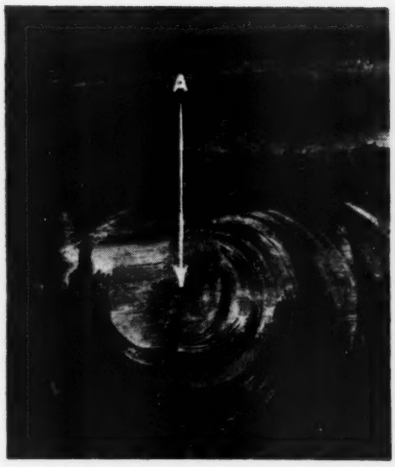
Chemical analyses made on shattered rim type failures have not shown any abnormalities in the steel and in most cases check analyses have been in close agreement with ladle analyses.

Examination of shattered rim type failures has indicated that the cause of failure in every case has been associated with internal discontinuities inherent to normal steel making practice. Most wheel failures of this type have occurred only after considerable mileage which would further indicate that, while the stresses induced in the wheel by high speeds and heavy loads are present from initial service, failure does not occur until enough of the tread has been removed by wear to place the discontinuity in a location of the rim most susceptible to stress fatigue. This then results in the propagation of progressive horizontal fractures beneath the tread. Usually these internal fractures make their first presence known by tread metal pushing out locally beyond the front face. This is often referred to as "roll-over." If this wheel remains in service, shell-out of the tread in this area will occur.

Circumferential cracking through the plate of diesel wheels occasionally develop in service, and these are believed to be the result of stresses incident to service conditions in combination with stresses set up in the wheels during manufacture. Not enough is known concerning the cause of this kind of failure. However, all wrought steel wheels through the nature of processing have internal stresses introduced in the plate section. Although these stresses exist in all wrought wheels, circumferential cracks do not develop until the addition of considerable external stresses from severe service conditions, such as extreme curves, heavy grades with resultant braking conditions, etc. When these internal and service stresses reach the danger point, fracture will occur and follow minor irregularities on the plate, such as roll laps or gouge marks. While surface defects of the plate are not ordinarily the primary cause of failure the do act as stress raisers and promote crack propagation. A small plate crack will grow circumferentially around the hub with the ends turning outward toward the rim into what is known as a "cupid's bow" crack. If a wheel in this condition is permitted to remain in service, the crack will eventually extend out through the tread.

Reports from 42 railroads indicate that failures resulting from thermal cracks occur more frequently than any other type. Thermal cracks doubtless are of importance but many of the reported failures of this type were reported for wheels which later were turned and restored to service. We are interested only in these failures which of their severity deemed a wheel useless for any future service.

Thermal cracks are caused by intensive brake heating. Service



Left: The F 36 Class CR wheel, which has shelled out, reveals the typical "oyster shell" appearance. The rolled-over portion of the tread which was the first sign of failure shows at the arrowhead. The fatigue crack started at A. This nucleus was found to be an inclusion of foreign material (dirt), not identified, which occurred during the manufacture of the wheel. Center: Another example of the shattered rim type of failure of an F 36, Class CR diesel wheel showing the shelled-out section of the wheel. The piece recovered from this section was 8-21/32 in. long, 3-9/16 in. wide and 11/16 in. thick at its deepest point. Right: Cross-section taken at the center of the defect. It shows the amount of tread rollover, the nature of the crack and the fissure in the center which resulted from inclusion of dirt in the steel.

conditions on railroads today call for high speeds and heavy loads which in turn require more and heavier braking. Heavier braking in turn generates higher trend temperature which is reduced by flow of heat into the rim and plate. The alternate rapid heating and cooling of the tread metal, while the body of the rim remains at moderate temperatures, leads to the development of localized stresses and formation of transverse cracks. The magnitude of the localized stresses embodied in the wheel rim determine the severity of thermal cracks.

As a result of investigation of wheel failures by railroads, the wheel manufacturers are cooperating in an attempt to produce a better diesel wheel for modern service conditions. One manufacturer is Reflectoscoping all diesel wheel rims in an attempt to eliminate the shattered rim type of failure. A two per cent rejection of wheels has been reported on the basis of indications found by this non-destructive method of testing.

All manufacturers have undertaken a program to study their individual processes in an effort to produce a wheel of cleaner steel, free from rolling defects and of uniform heat-treatment.

Some manufacturers are constantly conducting braking tests on their wheels to further study the effects of thermal stresses. Service conditions are drastically assimilated in wheels by mounting them vertically and rotating to speeds as high as 120 m.p.h. Brakes are then applied until the rim of a wheel becomes cherry red and the temperatures immediately decreased by water quenching.

The machining of wheels over all may have certain advantages toward preventing failures. Some of which are:

(1) Removal of weak, decarburized metal from the surface of the plate of the wheel.

(2) Removal of surface imperfections produced during the manufacturing processes.

(3) Producing more uniform shape and thickness of plate and a better uniformity of radii to hub and rim which should improve the distribution of stresses thereby reducing the tendency of stress fatigue failure.

(4) Producing a better balanced wheel.

(5) Producing a surface, clean and smooth, free of mill scale, etc., to facilitate routing inspections of the wheels after they have been applied in service.

In connection with the sand or shot blasting of new diesel wheels, one railroad used a conventional flat car and provided thirty-six individual racks permitting mounting of wheels through the hubs. With this arrangement, each wheel may be turned with little effort by the last operator so that all mill scale may be removed. In the construction of this special wheel car pieces of 10-in. channel iron were used, bent slightly so that the hub

(Continued on page 94.)

Left: A still further example of the shattered rim type of defect involved in an A 40 Class BR diesel wheel after 10 months' service. A section of the wheel slightly more rolled-over in one location of the wheel face when chipped away showed this condition. This defect was found by an I.C.C. inspector. Center: Chalk-marked locations of defects in an A 40 Class BR wheel as a result of Magnaglo inspection. Right: Grinding away 1/16 in. of metal from the upper left hand Magnaglo indication showed the defect actually had considerable depth.

Joint Session Probes Ways To Reduce Operating Troubles

Train construction is an engineering subject, but little consideration is given to this thought. The automatic coupler shank, yoke and knuckle have their limitations, just as the rail or bridge has its carrying limits. Motive power has increased in tractive effort more rapidly than the car builders could construct cars to meet this enormous pulling force. Therefore, we find in our trains, cars not capable of withstanding the high starting tractive effort of modern diesel power. The tensile strength of a modern coupler, thinking of the shank or yoke on freight cars, is 250,000 lb. without defect; yet a four-unit diesel develops 248,000-lb. starting tractive force. Couplers are not just pulled out—they are stretched out when starting heavy trains.

So spoke A. M. Malmgren, general diesel and air brake supervisor of the Frisco in introducing his paper on how to handle present weight trains and establish good instructions for proper train handling.

Rules Must Be General

Varying conditions of weather, grade, speed, train make up, and timing by the individual, all have their effect on brake applications, whether for slack control, slow-down, or stop. Rules must be general, with instructions to the engineman broad to cover the several conditions. The engineman then should think of these instructions and combine them with his experience in planning a brake application, taking into consideration all the existing conditions. Rules should be written based on the locomotive brake equipment, such as type of feed valve, whether brakes on the train are released by feed valve pressure or main reservoir pressure, main reservoir volume and pressure, the conditions of air pressure, control, and volume on the locomotive, plus the brake equipment on cars, train make-up, train length, speed, terrain, brake applications, and weather.

Long Trains Need Changed Rules

The early training of enginemen that stopping and slow downs were to be made by stretched slack is difficult to change. Before diesel power, trains of more than 75 to 80 cars length were seldom handled. Diesel power has increased train lengths to where a changed method must be employed. Here is where the time element must be given consideration. There are two stages of service braking with the "AB" brake. Quick service and service. In a train of 75 loads, each car weighing 50 tons, piston travel 8 inches, braking 60 to 75 per cent of the light weight of each car, the braking force of the load would be approximately 30 per cent of the gross weight of the car. The quick service activity through the train would be about 13 to 14 cars per second, therefore, a time of 6 to 6½ seconds would elapse from the time the head car brake responded to the quick service activity until the rear brake would respond. Under certain grade profiles it would be possible to keep the slack stretched in this length of train, but if on a descending grade the slack would close in before the rear brake became effective. The same condition would exist if all cars were empties, but with less impact to the rear cars.

How to Make Up Trains

Ideal train make-up would be empties spaced proportionate to the loads, such as having two loads then one empty. As this type of make-up is impracticable, the next best is for the loads or majority of heavy loads to be located in the forward half of the train. This reduces the weight of the rear of train, resulting in less severe impacts from run-ins and stretching out, with possible coupler failure when slack runs out.

To keep the train slack stretched when braking, there are two conditions necessary:

1—Heavy loads in first half of train.

2—Speed not less than 20 m.p.h.

Physical and operational factors having a marked effect upon the degree to which the slack is kept stretched during braking are: difference in time between the application of an effective brake on the front car and on the rear car; profile of the railroad at the time of brake application; and the availability and use of the tractive effort of the locomotive.

Why Put Loads Up Front

Since the average freight car weighs three to four times as much loaded as empty, the braking force is three to four times as much on an empty as a loaded car. Therefore, slack will be stretched when a load is ahead of the empty, and bunched when the empty is ahead. Loads should not be behind the empties, because when making a slow down or stop, the lower braking ratio of the loads not only runs in the slack but their greater weight acts as a battering ram. This can crush a car from the squeeze instead of breaking a knuckle or doing less serious damage as when the loads are ahead of the empties. When starting, and the loads are on the rear, they will act more as an anchor, especially when starting on an unfavorable grade.

There is a belief that where serious damage is done there should be severe shock, and that without such shock, no one can be responsible for the damage. This is wrong—where the most serious damage is done, there is sometimes an insignificant shock, and none at the locomotive or caboose.

One Cause of Stuck Brakes

The resistance to the air flow in a brake pipe is not noticeable in short trains but is very pronounced in long trains. Thus, the longer the train, the greater will be the time between the application of the brake nearest the discharge from the brake pipe and the brakes farthest from that point. The same is true of the time between the control valves moving to release position. These differences in time between the head and rear car brakes applying and releasing cause slack action. Both the recharge of the auxiliaries and the rate of brake pipe pressure recovery during releases is slow, particularly in the pressure zone just below feed valve setting. Since it is this pressure rise that moves the pistons in the AB valves on these rear cars to release, an attempt to release the train brakes after a very light brake pipe reduction is most certain to result in stuck brakes, and is most critical on long trains. Hence, it is far better to increase the light application to one of sufficient value to insure all brakes releasing, rather than attempt a running release of a light reduction.

The automatic brake valve used by the engineman who is to control the train brakes must alone be cut into the brake pipe. To cut in a brake valve on any another locomotive in the train to aid in charging, recharging, releasing, or for any purpose is wrong. It is proper to do this only where evident lack of control by the engineman in charge is producing a dangerous condition, and then only to stop the train. Next locate and remedy the trouble, cut out the brake valve that was cut in to stop the train, and before proceeding make the brake pipe test from the brake valve in control. Assistance in re-charging and releasing of a train from any source should be avoided as this aid, if unable to be maintained from the engine in control, will result in struck brakes. If another brake valve is left cut in, the train safety will be endangered, as a service application will be delayed and a needed emergency application can be prevented.

Where a dynamic brake is available, and the grade is heavy enough to require the use of the air brakes as assistance, the problem of recharging the brakes is relieved by the additional time added by the retarding force of the dynamic brake. Since the dynamic brake only retards rotation of the locomotive wheels, it will close in the slack and cannot be used when the stretched-slack method of braking is desired.

Braking Passenger Trains

Passenger train handling depends upon the type of brake equipment, whether electro-pneumatic, or the automatic air brake alone. If automatic air brake alone, piston travel, release choke for synchronizing time of releasing cylinder pressure, type of valve (UC-D22—or LN), position of graduated release cap, where car equipped with the "L" triple is located in train, and length of train, are all important. Slack between cars is reduced by the type of coupler, which is of value to the engineman in his train handling. Smooth stops must be made with brake cylinder pressure low at the last turn of the wheels, as high cylinder pressure will cause a "rock back" effect on the trucks, causing complaint from the passengers of rough handling.

Slid Flat Wheels

Slid-flat wheels on both yard and road diesels, and how to go about reducing their frequency, was described by R. H. Francis, general road foreman of equipment of the Frisco. He said that, beside poor rail conditions, two factors contribute to causing slid flat wheels even during dry rail braking. These are the transfer of weight and the intermittent wheel and rail contact.

Mathematical calculations indicate the axle loads of a passenger car having four-wheel trucks and clasp brakes (which is what diesels have) will change to approximately the following typical values when an emergency brake application is made:

Loads on front axle equals 115 per cent of normal static load.
Load on second axle equals 88 per cent of normal static load.
Load on third axle equals 112 per cent of normal static load.
Load on fourth axle equals 85 per cent of normal static load.

Two successful methods of compensating for this phenomenon when kicking a car ahead of or behind the locomotive, or when stopping cars ahead of or behind the locomotive and signal is received to stop are:

(1) Apply the locomotive brakes to its full value, closing the throttle at the same time. When the slack runs out or in (according to which end of the locomotive the cars are on and the direction of the movement), the locomotive brake should be momentarily released to such a value as to avoid "picking up" of wheels of the pairs that had been relieved momentarily of some of the weight. As the truck settles, reapply full brake cylinder pressure.

(2) Upon receiving stop signal, when slack is in, the throttle is closed reasonably fast, and the independent brake is applied quickly but only to a value of 10 to 15 lb. After the slack has run out, the independent brake cylinder pressure is increased to its full value.

With steam power, after the throttle is closed and the brake applied, the brakes seldom cause the wheels to "pick up" and skid, unless the speed is very slow at the time such action is taken by the engineer. There is not the sudden impact or lurch that occurs on diesel locomotives when the throttle is suddenly closed and brakes set fully because of the volume of steam that has to pass from the cylinders.

Moving Locomotives Dead In Train

A locomotive moved dead-in-train should be handled on the head end, and the dead engine feature cut in. Unless the spring is of sufficient value to prevent the brake system from charging too high (a 40-lb. spring has been found to be entirely adequate), an emergency application of the brakes will in most instances cause wheels to slide after the movement is reduced to low speed. It is also essential when units are towed dead to place the rotair valve in passenger or freight position, and not in passenger lap or in freight lap position. To place the rotair valve in lap position will result in brakes sticking if the double check valve in the independent application and release portion is leaking. On B units not coupled to A units, it is necessary to open the independent application and release cocks at one end of the units.

When a live locomotive is towed, it should be accompanied by a messenger, who should be in a position in the cab throughout the movement to prevent the brake cylinder pressure building up to a value that would result in wheels skidding. If a locomotive should be towed live without a messenger, the compressor should be held unloaded and the dead engine feature cut in to avoid charge main reservoir to a value that would not cause wheels sliding should an emergency action occur.

Release caps should be set on DIRECT RELEASE position. Brake piston travel should be as follows:

Passenger diesels—3 to 4½ in.
Freight diesels—3 to 5 in.
Yard diesels—2½ to 4 in.

Brake Tests To Be Made

After diesel units are assembled for making up a locomotive, a brake test should be made by those assembling the locomotive. After the engineman take charge, they also should check the brake equipment on each unit to know that it is conditioned, and set for the service engaged in. Afterward, each brake valve should be tested in its various positions, and the gages checked to know proper pressures are being indicated. The enginemen should also determine that brakes release properly and that an automatic application may be released with the independent brake valve, which should be done by the fireman checking from a ground position while the engineer operates the brake valves. Only after these tests are completed should the hand brakes be released and chocks removed.

A final check for flat spots on wheels should be made before leaving enginehouse tracks.

There is danger of the expense resulting from damage to wheels through skidding becoming very heavy on a railroad before those responsible become alert to the necessity of educating their enginemen and others in proper handling for avoiding such damage. It is a matter that must be followed up constantly by those in responsible position and every possible means used to maintain the highest possible standard of air brake maintenance and operation.

Discussion

One thing which contributes to slid-flat wheels when switching a cut of cars with a diesel is that it has only eight wheels to brake instead of the 16 wheels which were available on a steam locomotive and its tender. Another factor contributing to slid-flat wheels is that, while rail-wheel adhesion remains fairly constant, wheel-shoe friction rises slowly down to 5 m.p.h., then rapidly to zero. A means should be devised to compensate for this mechanical characteristic.

REGISTRATION AT COORDINATED MECHANICAL MEETINGS

Associations	1948	1949	1950	1951	1952	1953
Air Brake	222	229	176	280	135	192
Car Department Officers	403	449	373	563	523	520
Locomotive Maintenance Officers	653	644	746	1,017	840	950
Master Boiler Makers	275	258	216	215	127	172
Railway Fuel & Traveling Engineers	361	238	475	268	433	322
Electrical Section, A.A.R.	—	—	175	155	205	—*
Total Railroad Men	1,904	1,818	2,161	2,498	2,263	2,156
Non-member Guests	—	155	—	—	361	—
Allied Railway Supply	496	1,038	737	1,152	1,003	869
Railway Electric Supply Manufacturers'	—	—	236	168	305	—**
TOTAL	2,400	3,011	3,134	3,818	3,932	3,025

* Electrical Section met at Atlantic City.
** Atlantic City Convention in June and no exhibit at Chicago in September.

One road has improved switching speed and reduced flat spots by using a braking car equipped with straight air brakes and sanders. There are three such cars made from old locomotive tenders cut down and ballasted to 173,000 lb. They are used when humping more than 50 to 60 cars and the locomotive does not have sufficient brake capacity by itself.

One member disputed the statement that standard instructions cannot be issued and would like to see the Air Brake and the Railway Fuel and Travelling Engineers Association jointly put out a guide to freight train handling. To this it was remarked that the Air Brake Association has such a book on freight train handling. One member made the observation that you have to ride the caboose to really see how well how an engineman handles his train. It was wondered if heavy crater compound in gear boxes could cause wheels to slide as once they start a few added pounds of resistance will keep them sliding. It was also asked if the addition of too much oil to prevent hot boxes could not cause slid flat wheels as it drained out.

Multiple Capacity Freight-Car Brakes

(*Continued from page 77*)

the underside of the center sill. The registering bar is carried in rubber between the truck side frames. The weighing gear hook contacts the registering bar during brake pipe charge to measure the truck spring deflection from empty position and sets the compensating valve accordingly. It is then retracted to avoid wear and change in setting while running over the road.

After an initial drop to allow for permanent set in the truck springs, the breaking ratio is held constant up to the capacity of the brake cylinder. This provides for uniform train braking with cars having various degrees of partial loading.

There are about 2,000 sets of ABLC equipment in service, 400 of which are in operation on the Illinois Central and representative numbers have been inspected periodically by the AAR Brake Committee. A 40-month inspection was made recently, at which time the equipment was found in generally good condition except for some fire and mechanical damage. However, the committee members repeated the opinion expressed at previous inspections that an equipment easier to install, inspect and maintain would be desirable. This caused the air brake manufacturers to develop the ABMC equipment.

This equipment retains the differential brake cylinder of the the ABLC with added improvements, but substitutes a three-position strut cylinder and selector valve for the weighing gear and compensating valve. A standard AB-10 in. two-compartment reservoir has been substituted for the three-compartment reservoir. The strut cylinder is inverted from the empty and load equipments requiring its longest travel in load position. Thus if the strut cylinder is prevented from operating for any reason, the equipment will set for empty position to prevent a loaded braking force on an empty car, a principle carried over from the ABLC equipment.

Braking ratio for the ABMC equipment is held between 50 and 30 per cent. While this not as uniform for partial loads as the ABLC, it is felt to be adequate.

The ABMC equipment can be used for all car weights and capacities where the ABEL 7⅝ in., the ABEL-8 in., and the ABLC equipments have been used heretofore. It can also be used in most cases where the ABEL-10 in. equipment has been used with some compromise in empty and loaded braking ratios. The equipment has completed satisfactorily all of its development tests and is now being prepared for production. It is expected that some of these equipments will go into service early next year.

This report was prepared by G. L. Cotter, Director of Engineering, Air Brake Division, Westinghouse Air Brake Company.

Defects in Diesel Wheels

(*Continued from page 91*)

of the wheel will rest against them when hung on the spindles. The spindles are scrapped Hyatt inner races which were first annealed to permit necessary welding to the standards. The channel irons are reinforced with the center web on the outer rows while the inner rows are cross braced with bar iron. In addition to facilitating the blasting process, the special car eliminates excessive handling in that wheels may be loaded on the car at wheel beds, moved to the point where sand or shot blasting is performed and then to the processing shop or spot.

This report was presented by the LMOA Shop Practice Committee of which C. H. Spence, B&O, was chairman.

The "Presidents' Luncheon," attended by all association members at the Hotel Sherman on September 15.

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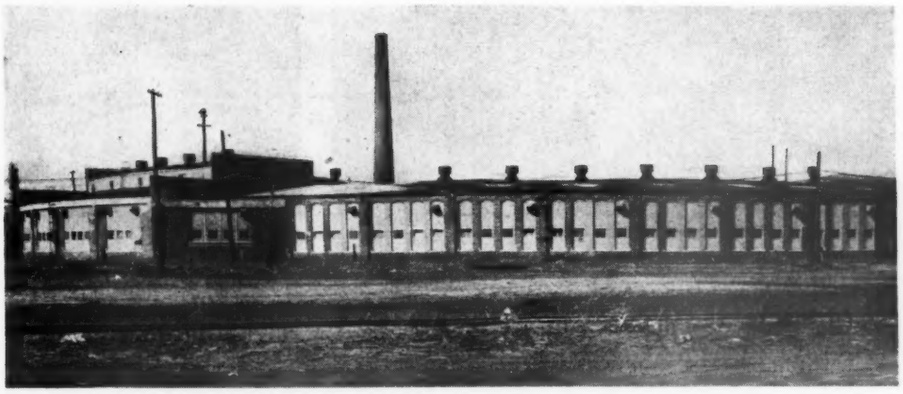


IHB Converts Gibson Terminal for Diesel Work

Roundhouse retained not only to save the cost of building a new structure but also for certain operating advantages

THE Indiana Harbor Belt handles repairs up to but not including complete overhauls to its fleet of diesel locomotives in a converted roundhouse at Gibson, Ind. The "roundhouse" form of structure was chosen over building a new rectangualr building partially because the structure was already in existence, partially because of advantages of this shape for IHB operation, and partially because the disadvantages associated with roundhouse maintenance of diesel power on many roads do not apply to this point because of the nature of IHB power.

All 118 units of the road's diesel roster are General Motors switcher type; 40 are 1,200-hp. and 78 are 1,000-hp. units. In this total, 66 units are equipped for multiple-unit operation, 52 units are single control only. One of the MU group is a 1,200-hp. unit, the remaining 65 are 1,000 hp. The IHB also operates two hump trailers which were converted from former electric locomotives. Each trailer couples to a diesel unit to boost low-speed tractive force for humping operations. Three 1,000-hp. switchers are equipped to operate with the trailers. These switchers have the same gearing as other IHB diesels, and can be disconnected from the trailers for general service.

With this type of locomotive fleet, made up entirely of switchers and operated mainly as single units, the roundhouse type of structure lends itself well for the maintenance handled at Gibson. Over and above the saving in cost of building a new structure and tearing down the old roundhouse, the building has one positive advantage over a conventional rectangular-shaped diesel servicing building. It eliminates the problem of what to do when the middle of three locomotives undergoing repairs is completed first. With the roundhouse type structure there is no problem of either having to move one of the locomotives on the end of the completed unit or of holding the completed unit until repairs are finished on one of the other two locomotives.

At the same time disadvantages usually associated with servicing diesel power in a roundhouse do not apply to any extent. The small percentage of operation conducted by two-unit locomotives causes no great problem. First, the units are coupled together, rather than being joined by pulling bars as is often the case with road units; hence they can be separated easily and quickly. Second, there are four stalls in the roundhouse which were lengthened to accommodate long-tender steam locomotives. These are long enough to accommodate a pair of switchers coupled together.

Rearranging the Roundhouse

The original structure had 38 stalls, of which 33 have been retained. Four, Nos. 35-38, are 130 ft. long; the remainder are 115 ft. long. Stalls 1 through 5 housed the steam locomotive drop pit. This section of the house was torn down to build a 50-ft. by 70-ft. engineman's service building which houses the road foreman's and the crew dispatcher's offices. It has one locker room with washing facilities for IHB enginemen, a second complete with two sleeping rooms with four bunks each for Michigan Central crews.

Stalls on through 15 were left as they were and are for future use to store track repair equipment. Stalls 16 through 25 are are used for a machine shop area, office space and washroom facilities. All but three tracks, (18,

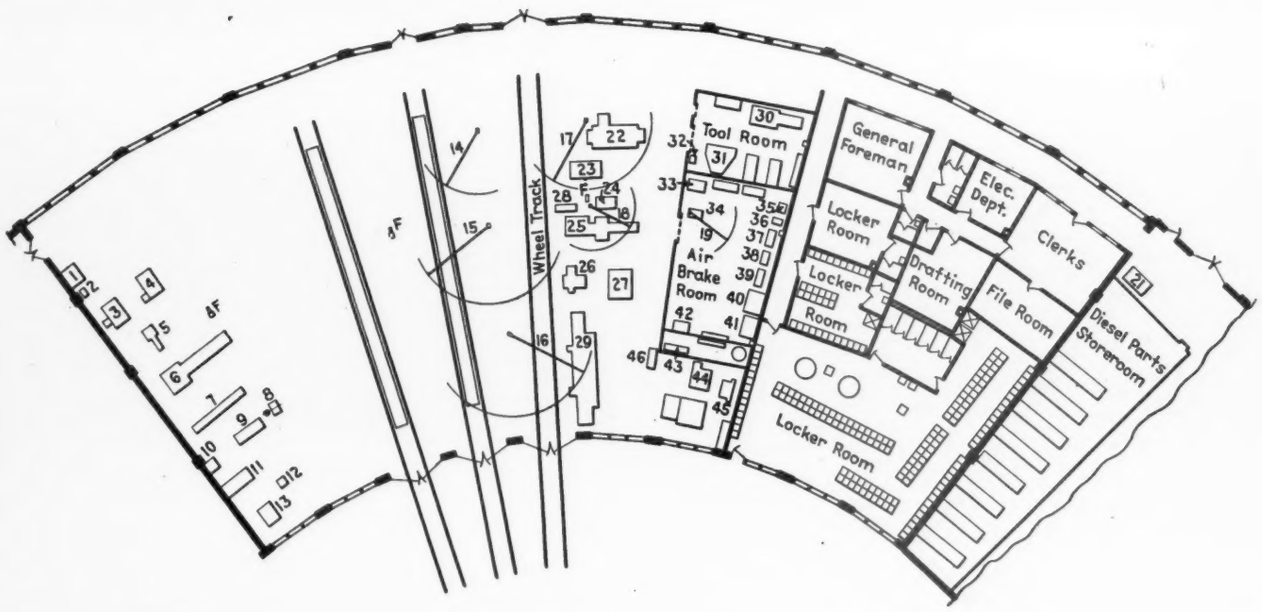
The cleaning station (left) in stall 34 operates about 3 hr. per day, handling both filters and rough cleaning. The hose reels (right) to which water is fed through a sealed shaft, do not have to be connected or disconnected.

Trucks are kept the same distance apart as when under the locomotive by this spacing bar. Its U-shaped end is hinged at the bottom to simplify application when the trucks are under the locomotive.

Because coaling facilities were torn down when the IHB dieselized, the locomotive crane was converted to burn oil.

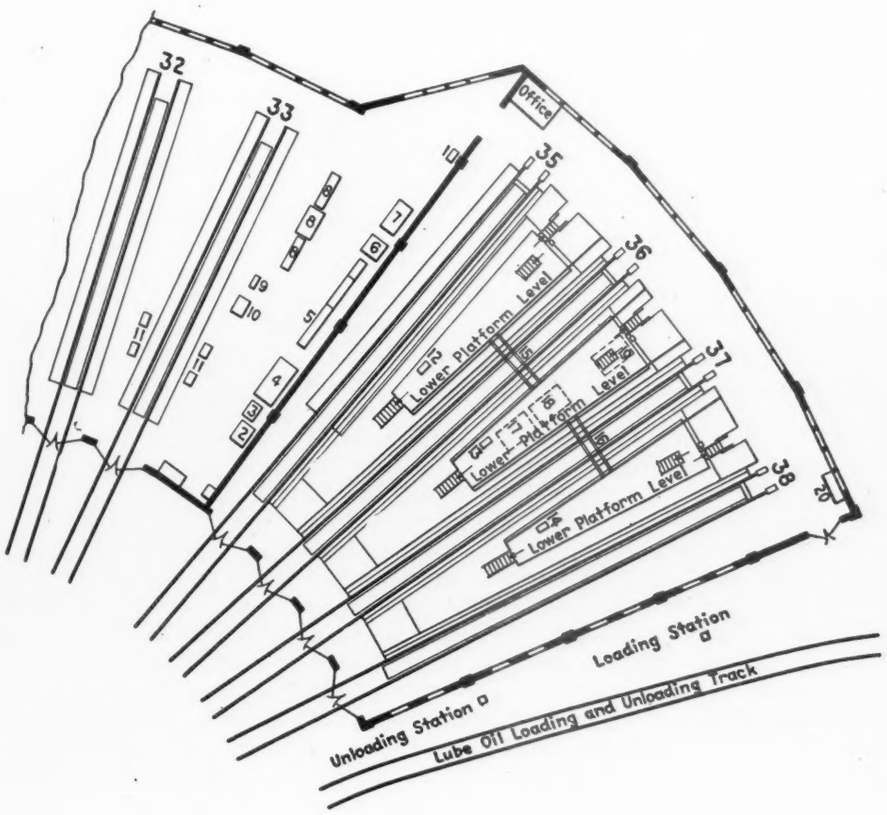
Double-wedge arrangement for straightening grab irons, with a portable platform in the background.

Portable cleaning arrangement for diesel engine heads cuts cleaning time from 30 to 1½ min.



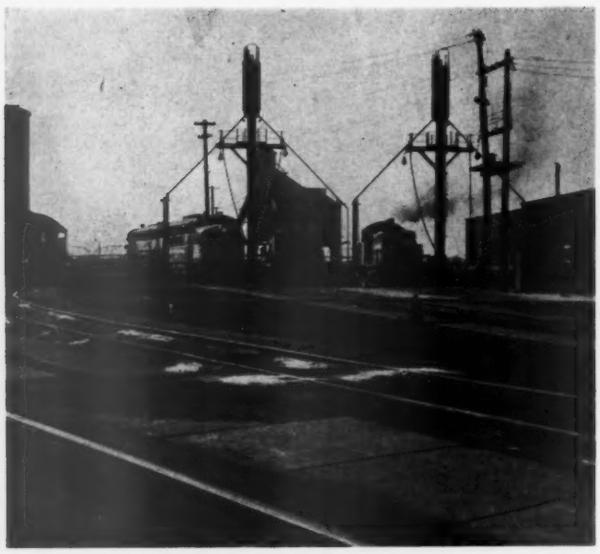
1—Condensate return line pumps
2—Battery charging station
3—Wood smoothing planer (No. 4½)
4—Rip saw (14-in.)
5—Band saw (No. 58, 42-in.)
6—Boiler sheet rolls (10-ft.)
7—Pneumatic flanging clamp (10-ft.)
8—Double emery grinder (18-in.)
9—Surface plate
10—Pneumatic bending press
11—Bradley hammer (200-lb.)
12—Anvil
13—Forge
14—Jib crane (1½-ton)
15—Jib crane (5-ton)
16—Jib crane (5-ton)
17—Jib crane (1½-ton)
18—Post crane (½-ton)
19—Post crane (½-ton)
22—Carlton radial drill (6-ft.)
23—G&E heavy duty shaper (28-in.)
24—Drill press (20-in.)
25—American heavy duty lathe (24-in.)
26—Chambersburg bushing press (150-ton)
27—Landis double bolt threader (No. 2½)
28—Racine power saw (6-in. by 6-in.)
29—Sellers car wheel lathe (42-in.)
30—Engine lathe (24-in.)
31—Thomson tool grinder
32—Double wheel grinder, (10-in.)
33—Diesel valve grinder
34—Diesel head repair table
35—Double wheel grinder (10-in.)
36—Small drill press
37—Vent valve test rack
38—Transfer valve test rack
39—Independent brake valve, sander and bell ringer
40—Double feed valve test rack
41—E. T. brake equipment test rack
42—Safety valve test bench
43—Air pump and reservoir
44—Gap shears
45—Rolls (4-ft.)
46—Beaver model "A" pipe threader

Heavy work and parts-cleaning section of the roundhouse.



1—Double emery grinder (10-in.)
2—Hot vat for diesel parts
3—Drain tank
4—Hot vat, Magnus Aja-dip
5—Farr filter wash
6—Farr filter oiler
7—Filter draining cabinet
8—Filter parts washing units
9—Bowser spray unit fire prevention
10—Portable unit for cleaning diesel parts
11—Portable electric power jacks (four 35-ton)
12—Bowser spray unit fire prevention
13—Bowser spray unit fire prevention
14—Bowser spray unit fire prevention
15—Overhead traveling crane (2-ton)
16—Overhead traveling crane (2-ton)
17—Oil flushing tank
18—Clean lube oil supply tank
19—Dirty lube oil tank
20—Pump and meter unit (for lube oil)
21—Fire hose cart

Arrangement and location of facilities in the section of the house used for machine shop, wheel and air brake work.



The outdoor servicing facilities handle road power for the Michigan Central in addition to IHB switchers.

The wire-enclosed storeroom has 12-ft. high sliding doors to allow trucks to back in for deliveries.

19 and 20) have been removed and level flooring installed in this area. Track 18 is used for overhauling steam cranes, track 19 for diesel truck dismantling and repairs. Track 20 is a wheel track alongside which is a 42-in. car wheel lathe. This lathe is used for turning threads (the only wheel work done at Gibson) on about 90 car wheel sets per month for the IHB, 25 for outside industries and 20 diesel wheel sets for the IHB. Mounting, demounting and other car and locomotive wheel work is done at other points.

Stall 26 has been converted to a diesel parts storeroom. Large double doors (10 ft. wide and 12 ft. high) are installed in the outside wall of the roundhouse adjacent to this storeroom to allow large trucks to enter the house. Similarly, large and high doors are installed at the delivery entrance to the storeroom to allow the trucks to back up and deliver directly inside to the storage area. The outside doors are hinged, the inside doors are on overhead rollers and slide to open.

Stalls 26 through 33 have floor level running repair

Because there is no drop pit at Gibson, wheel and traction motor changes are made by raising the unit with four electric jacks.

pits. Diesels are maintained in these stalls with the aid of portable platforms, which have parts-holding trays along the outer edge. Stall 27 is used to store heavy materials such as reservoirs and traction motors. The track in stall 34 was removed and this area is now devoted to filter and parts cleaning. The cleaning station is operated about three hours per day to fill the road's requirements. Stalls 35 through 38 have depressed floors and platforms for heavier maintenance. Stalls 32, 33 and 35 have jacking walls.

A number of interesting procedures have been developed at Gibson for making diesel repairs. When grab irons become bent, as often occurs when using the pole from the push-pole pocket, they are straightened in place by a sledge hammer and two wedges placed as shown in one of the illustrations. One man holds the left wedge by the handle while another sledges it down to re-align the grab iron. This procedure is fast and simple, and has the added advantage that it can be used anywhere in the yard.

Diesel engine heads are cleaned on a four-wheel portable cleaner which has cut the time for the operation from 30 minutes to 1½ minutes the top platform of the cleaner has a plate, with holes for the studs, which serves to hold the head in place and to eliminate having to remove them. The head is turned by an air motor for cleaning with wire brushes. At the time the accompanying picture was taken, the brushes were held by hand, but this has since been modified by the addition of levers which hold the brushes.

The hose reels installed at Gibson require no connecting or disconnecting for washing off locomotives or other operations. The water is fed directly to the center of the reel through a sealed shaft. A quick-opening valve immediately above the reel controls the flow of water.

Trucks are moved and spotted simultaneously by means of two slightly different connecting bars. One bar connects the switching locomotive to one of the trucks, and the second connects the trucks together. The latter bar is of such a length, varying between different locomotives, that, when applied between the trucks, the correct center-to-center distance between the trucks is automatically attained. Spotting is further facilitated by the rigid connections, with no slack, of both of the bars.

The bar that extends between the trucks joins to each truck through a U-shaped end hinged at the bottom. This

hinging simplifies application of the bar when the trucks are under the locomotive; the bar can be laid in place, the bottom leg of the end raised to position, and the fastening completed by screwing the bolt into the nut welded on the top leg.

The bar that connects one of the trucks to the locomotive is similar, except that the U-shaped end which fastens to the locomotive is in one piece, not hinged. It connects to the locomotive by removing the coupler knuckle, and dropping a knuckle pin through the openings in the end of the bar.

Straddle Car Put To Many Uses by the SP

A total of ten straddle trucks are in use on the Pacific Lines of the Southern Pacific for hauling any type of materials loaded on bolsters (or on pallets or trays loaded on bolsters) that can be straddled with the machine. In addition to handling all kinds of lumber, straddle truck operations have been extended to hauling pipe, brake shoes, wheels, boiler tubes and angle and bar steel. Drum stocks, such as paints, oil, saturated waste, etc., which in the past were handled by fork lift trucks that could move only four 50-gallon drums at a time, are now handled twelve at a time by straddle trucks. As scrap develops in the mechanical departments, it is placed in trays on bolsters at various locations throughout the yards, picked up by straddle truck and handled in one operation direct to the scrap dock. This operation has released fork lift trucks for other services and for short haul moves where they can be used more economically.

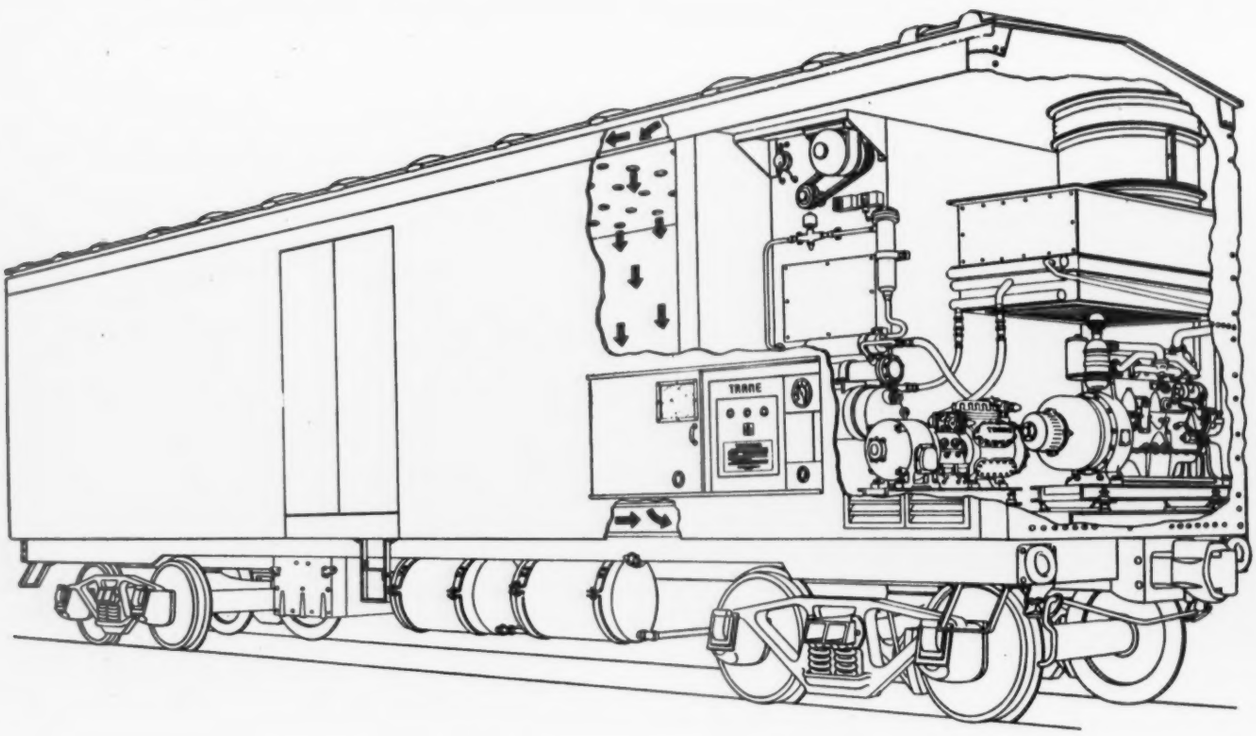
Five of the trucks are in service at Sacramento, two at West Oakland, two at Los Angeles and one at El Paso. Handling loose wheels is a principal function of the trucks at all points except West Oakland, which is supplied with mounted wheels from Sacramento in special double-deck cars from which the wheels are unloaded directly at the point of use.

At Sacramento the loose steel wheels loaded on the special bolsters are hauled by straddle truck to and from the sand blast and to the car machine shop for mounting. The straddle trucks also haul demounted scrap steel wheels from the car machine shop to the scrap dock where they are loaded with magnet crane onto cars for shipment on sale orders.

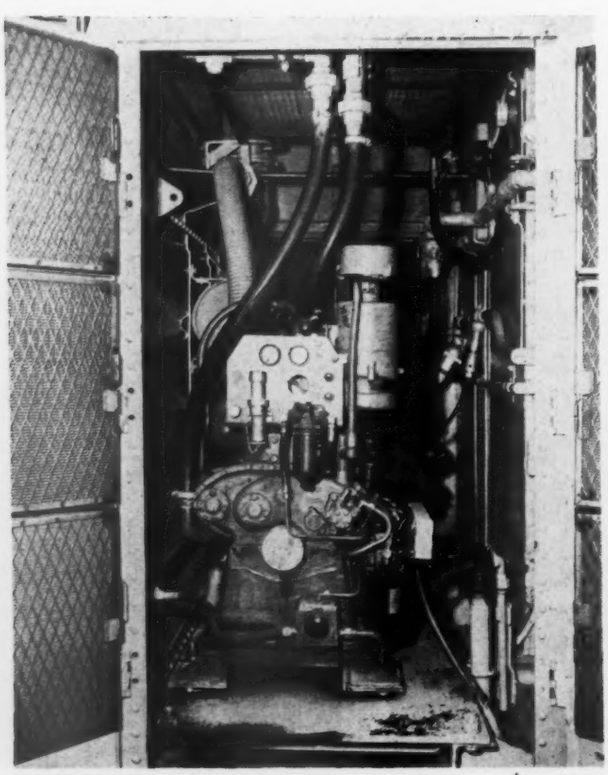
At Los Angeles, straddle trucks are used to handle mounted steel wheels from mounting press to point of use, and scrap mounted wheels from the coach yard to wheel pit for dismounting. At El Paso, mounted cast iron wheels are handled by straddle truck from dismantled equipment to the wheel shop for dismounting, and new cast iron mounted wheels are carried from the mounting press to the light repair track.

The loose wheel bolsters were designed at Sacramento General Stores and built in the tank shop at that point. The bolsters for handling these mounted steel wheels are 4 ft. 6 in. wide and 24 ft. long, and are made of 6-in. by 6-in. stringers. They will carry three pairs of mounted passenger car wheels.

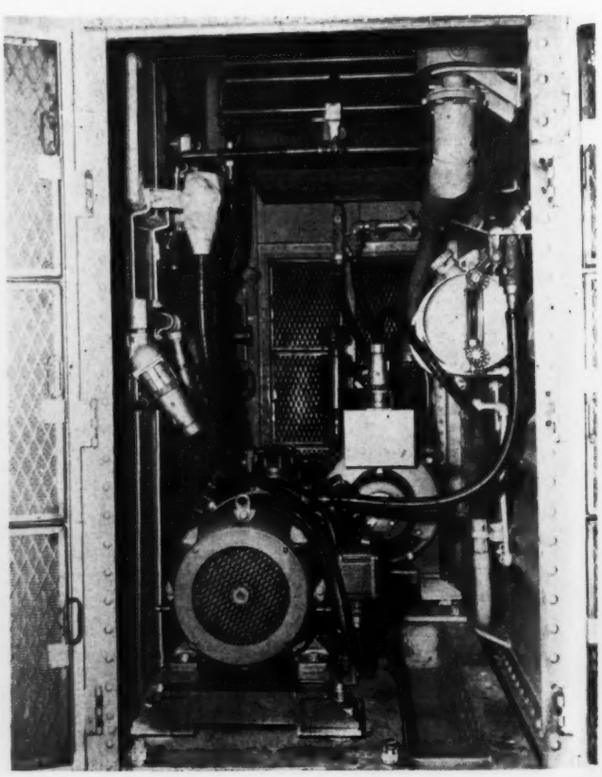
The straddle trucks handle a dozen loose wheels. They can also carry twelve 50 gal. drums or three pairs of mounted passenger-car wheels.



Santa Fe MTC Reefers



Hercules 52-hp. diesel engine furnishes power for mechanical cooling.



The Trane refrigerant compressor is driven by a 15-hp. electric motor.

Tested in Revenue Service

Initial Trane-equipped car, in first west-east revenue run, keeps 63-ton load at –8 to –10 deg. F. without intermediate attention.

Gages at the control end of the Santa Fe MTC refrigerator car are protected by a sliding door in the side of the car.

Loading instructions are placed on bulkhead at the compressor end of the car.

Hinged metal floor racks and wood sidewall racks assure free movement of cool air.

Frozen strawberries being moved through protected doorway into the MTC car.

HOW MTC CARS WERE DEVELOPED

The specifications for the refrigerating machinery of the Santa Fe MTC cars are the result of an investigation which began shortly after World War II. This included building an experimental car, complete with equipment somewhat similar to that in the new cars now being built. The car was fitted with an elaborate set of instruments. It made several actual trips, accompanied by a party of test engineers, and was subjected to numerous stationary tests involving almost continuous recording of data. The specifications developed assure substantial reserve over the minimum requirements deemed essential for maintenance of proper load conditions even in the hottest weather.

THE Santa Fe recently turned out of company shops at Wichita, Kan., the first of 30 MTC (mechanical temperature control) refrigerator cars. Ten cars each are being supplied with equipment furnished by the Trane Company, the Carrier Corporation, and the Frigidaire Division of General Motors. The first car is Trane equipped. Although the details vary somewhat, each manufacturer is furnishing components of substantially similar capacity. The equipment is located at one end of each car in a space slightly larger than that occupied by a single ice bunker.

Refrigerating Capacity

The cars are 50 ft. long and of steel construction. They are being equipped with roller-bearing trucks, sidewall racks, sliding doors, metal floor racks and strap anchors suited to modern means of material handling.

The Trane-equipped car started on its initial run in revenue service on June 4, carrying 120,000 lb. of frozen strawberries from Bakersfield, Cal., to Jersey City for Snow Crop Marketers, a division of Clinton Foods, Inc. It was routed via the Santa Fe to Chicago; Pennsylvania to Croxton, N. J., and Erie delivery. It moved under Mechanical Refrigeration Rule 171 with refrigeration charges the same as for water ice and salt under standard refrigeration. During the portion of the trip on the Santa Fe—4½ days—the temperature within the car was kept between —8 and —10 deg. F. No attention was required by the mechanical cooling equipment. In a preliminary shake-down test of the car a temperature of —12 deg. F. was reached in 7 hr. and —25 deg. F. in 12 hr. after starting, against an outside temperature of 58½ deg. F.

Refrigerated air is discharged into a shallow plenum chamber formed by a false ceiling. This is perforated with small orifices to provide a pressure distribution system. Part of the air is free to percolate down through the load, while the remainder flows down around the load in spaces formed by side-wall racks to return under the floor racks to the coling coils. It has been demonstrated that, besides insuring uniform temperature, this arrangement permits cooling of the load, if necessary, along with the advantage of a moving film of cool air surrounding the load.

DIMENSIONS AND WEIGHTS OF SANTA FE MTC CAR

Length, coupled, ft. in.	50–0
Overall width, ft. in.	10–7
Length inside, ft. in.	44–0
Width inside, ft. in.	8–6
Height inside, ft. in.	8–2
Cubic capacity, cu. ft.	3,054
Light weight, lb.	82,000
Nominal capacity, lb.	127,500
Load limit, lb.	128,000
Insulation thickness, in.:	
Floor	7
Sides and ends	6
Roof	8

The Refrigerating Plant

Power is supplied by a diesel engine directly connected to an a.c. generator. The minimum requirement for the engine is 40 hp. It operates on locomotive fuel carried in four 100-gal. tanks located underneath the car near the center. Some cars will have four-cycle engines; others will have two-cycle. The generator supplies 25-kw., 60-cycle, 220-volt, three-phase current.

Freon-12 compressors are used, driven by 15-hp., totally enclosed high-torque motors. The compressors have capacities of 26,000 B.t.u. per hr. at —20 deg. F. evaporating, and plus 120 deg. F. condensing, saturated refrigerant temperatures. A minimum of 800 sq. ft. of condensing surface is required. All coils have copper tubes and copper fins.

Condensation of the refrigerant requires 7,000 cu. ft. per min. of air at 1-in. static pressure. This air is drawn through both sides of the car past dynamic grills and panel filters, upward through the condenser, horizontally mounted above the engine, then through the radiator, which is incorporated in the condenser frame, and is finally discharged vertically through a single hatch in the roof by an exhaust fan driven by a 5-hp. motor. This method of circulation was adopted to avoid the adverse effect of side winds as well as the nuisance of air blasts at a lower level.

The evaporator has a minimum of 550-sq. ft. of total surface, with at least 4,000 cu. ft. of air per min. at 1½ in. static pressure, plus coil loss delivered by the blowers. The evaporator and blowers are in an insulated well behind the load bulkhead. The blowers are belt-driven by 3-hp. motors mounted in the engine compartment.

Rubber mounts are used for the power plants and compressor sets and vibration eliminator and flexible hoses are installed in various refrigerants and other lines. Auxiliaries and details of the Trane refrigerating plant are shown in a table.

SPECIFICATIONS OF THE REFRIGERATING PLANT ON THE TRANE-EQUIPPED MTC CAR

ENGINE: Hercules DJXH, Bore 3¾ in., stroke 4½ in., 6 cylinders, 4 cycle, 298 cu. in. displacement, 52 hp. at 1,200 r.p.m. High temperature and low oil pressure protection.

FUEL: Diesel locomotive, carried in four tanks with 400 gal. total capacity, sufficient for approximately 12 days at about 1.4 gal. per hr.

BATTERIES: 24-volt, 3 trays, Exide I/C, MV-17D, 12 cells.

ENGINE RADIATOR: Overhead, above condenser. Copper fins and tubes. Total surface 292 sq. ft. Capacity, 9 gal. water and ethylene glycol, half and half for approximately minus 50 deg. F. protection.

A. C. GENERATOR: D. W. Onan, 25-kw., 220-volts, 3-phase, 60-cycle.

COMPRESSOR MOTOR: Louis Allis, 15-hp. high torque, totally enclosed, 1,750 r.p.m.

COMPRESSOR: Trane B-516 L. Bore 2½ in., stroke 2 in., 6 cylinders, 59.6 cu. in. per min. displacement, low lift valves, nominal rating at 40 deg. F. suction and 105 deg. condensing, 15 tons. Rating at minus 20 deg. evaporating and plus 120 deg. condensing, 29,640 B.t.u. per hr.

CONDENSER: Overhead, horizontal, copper tubes and fins, 887 sq. ft., total surface.

CONDENSER-RADIATOR FAN: Aerovent, 8-blade, 10,050 c.f.m. at 1 in. static pressure. Louis Allis, 5-hp. 1,760 r.p.m. totally enclosed motor.

CONDENSER AIR CIRCULATION: In both sides of engine compartment, through panel filters past equipment, upward through condenser then radiator and out through the roof hatch.

EVAPORATOR: Copper tubes and fins, 554 sq. ft. total surface.

EVAPORATOR BLOWERS: Two Trane 12¼-in. double width, backwardly inclined, 80 per cent blade width, 2,250 r.p.m. 5,000 c.f.m. at 2.3 in. static pressure. Belt-driven from Louis Allis, 3-hp. totally enclosed motor.

FALSE CEILING: Extends throughout length and width of loading space, 4¾ in. below regular ceiling. Approximately 660 one-inch diameter holes equally spaced.

AIR CIRCULATION: Discharge from blowers into false ceiling plenum space, down through holes through load and wall rack space, under floor racks upward in evaporator well, through evaporator coil to blowers.

DEFROST: Automatic. Initiated by differential pressure switch when air pressure drop through coil increases as a result of frost accumulation. Terminated by timer. Six kw. in electric heaters built into evaporator, also heater in drain pan to remove meltage.

REFRIGERANT: Approximately 75 lb. of Freon-12.

REFRIGERATION ACCESSORIES: *Receiver*, to hold most of refrigerant charge. *Dehydrator*, to remove moisture from circulating refrigerant. *Strainer*, to remove foreign matter. *Solenoid valve*, to control flow of refrigerant to evaporating coil. *Expansion valve*, to throttle liquid to lower pressure and control distribution to coil. *Heat exchanger*, to prevent liquid drops from reaching compressor and to improve efficiency of system. *Discharge by-pass line*, to unload compressor in starting.

CONTROLS: 24-volt d.c. thermostat to cycle refrigeration between minus 12 deg. F. and minus 6 deg. in loading space. Dual pressure cutout and oil pressure safety switch.

Protective Devices

Customary temperature and pressure protective devices are incorporated in the machinery. A thermostat with its bulb in the return air stream controls cycling of the compressor between —6 deg. F. and —12 deg. F. The engine and condenser radiator fan operate continuously. The evaporator blowers are also in constant operation except during defrosting periods.

Defrost cycles are automatically initiated by means of a differential pressure switch, which is connected to pressure-sensing taps, one below and one above the evaporator coil. As frost accumulates, resulting in impaired performance because of lower suction pressures and reduced air flows, the air-pressure drop across the coil increases to actuate the switch. The compressor and blowers stop, while the electric heaters incorporated in the coil assembly come into operation to dispose of the frost. A timer, which is also started by the differential-pressure switch, terminates the cycle and restores refrigeration. A minimum of 6 kw. of electric defrost heat is required to provide quick defrosting of the evaporator without materially warming the air in the loading space.

The power plant and the compressor set are each secured by four bolts. Refrigerant lines to the compressor are joined by self-sealing couplings. Plug and receptacle connectors are used in the power and control wiring. Pipe unions connect the oil, water and engine exhaust lines. This arrangement permits quick replacement of these assemblies and, although equipment of three different makes is employed in the 30 cars, it will be possible to interchange the power plants or compressors if desired.

The Santa Fe fleet of 30 MTC cars will be used in transporting frozen foods, particularly those with low freezing points, such as fruits in syrups or concentrated citrus juices. It is anticipated that ultimately similar cars will replace those currently in frozen-food service which are equipped with ice bunkers and ordinarily are refrigerated by ice and 30 per cent salt.

ELECTRICAL SECTION

Rewiring of Diesel Locomotives

Why and when locomotives must be rewired – How to do it – And what it costs

UNTIL about two years ago, practically all diesel-electric locomotives were wired with varnished cambric-insulated wire. When it was installed, it was considered to be the best thing available, but oil, moisture and vibration have taken their toll and there is a lot of locomotive rewiring to be done.

The Locomotive Maintenance Officers' Association's Diesel Electrical Committee accepted locomotive rewiring as one of its assignments and reported on it at the annual meeting of the Association, held in Chicago during the week of September 14, 1953. Some very definite recommendations are made.

According to the report, the subject of rewiring merits particular attention this year, because so many railroads are finding it necessary to completely rewire locomotives after only 5 or 6 years of service, instead of 10 to 15 years service which is to be expected, and has actually been obtained on some locomotives. The locomotives which are causing trouble are primarily those which are in heavy duty passenger service.

About 20 years ago, with the advent of diesel electric locomotives, braided varnished cambric insulation was coming into extended use in this country. This was perhaps due to the fact that the utilities and industry were increasing their operating voltages and currents. The temperature rating of varnished cambric is 85 deg. C., thereby affording a higher current carrying capacity. It is also oil resistant and therefore it is not surprising that the locomotive manufacturers first used it rather than rubber insulation, which has a temperature rating of only 75 deg. C.—and at that time, rubber was not oil resistant. Neoprene compound jackets for covering rubber insulated wires were known of, but very little used.

The experience with varnished cambric removed from diesels after a term of service has been as follows:

1. Control wiring removed from conduits located in roof and above floor level was in much better condition than wire removed from conduits at floor level and under the car body. Wire removed from conduits under floor level was oil soaked and insulation badly deteriorated, while wire removed from above floor level was dry and brittle, but might have lasted several years longer, had it not been disturbed.

2. Wire in immediate vicinity of steam generator was more brittle and insulation dryer than at other locations.

3. Power wire and insulation had deteriorated much worse in and around main generator pits than at other locations. The water that at times is bound to be below floor level has the effect of completely saturating the insulation, due to a phenomenon called electrical osmosis. There have been a number of cases where in attempting to pull oil traction motor leads out of the conduits, the wire came out but the insulation remained in the conduit.

The requirements for a diesel-electric locomotive wire are as follows:

1. It must be oil and chemical resistant.

2. It must have heat resistance to retain elasticity and must be non-flammable.

3. The insulation must be strong enough to give protection against the constant pounding and vibration to which it is subjected in a locomotive.

4. It must have insulation to withstand high dielectric values.

5. It must have an overall diameter that, size for size, order for order, does not vary.

To meet these requirements, some applications have been made of Flamenol wire for control circuits, but this has not been satisfactory because the insulation fuses together between wires too easily, making it extremely difficult to pull out of the conduit for renewal, and making it impossible to renew a single wire. Neoprene jacketed rubber insulation is presently regarded as the best, and is being widely used. It holds up much better in the grease, oil and moisture which is present on diesels, and the expectation is that it will far outlast the varnished cambric.

For the rewiring procedure the following matters need standardization:

1. There are too many different sizes of wire as between identical jobs to be done on different types of locomotives. This requires the stocking of too many different sizes and types.

2. A great many different types of lugs are being used by the builders and these also should be standardized to simplify the stocking and the application problems.

3. Standard lists need to be made of wire required on various makes for the rewiring job.

Proper application of the wire when rewiring locomotives has fully as much to do with the service life as does the type of wire used. All wiring except traction motor cables should be run overhead and not in the floor of the locomotive. The installation of the overhead wiring should be made water tight so that it will permit engine room washing without causing grounds and short circuits. Overhead control wiring should be run in waterproof type ducts rather than in conduits because on such type installations the wiring can be inspected periodically and re-

moval is greatly simplified. However, the wiring in these ducts must be bound and supported in free space inside the duct at approximate 18-in. intervals. With loose wires vibrating and wearing holes in the insulation, a great deal of trouble has been experienced on locomotives only one year old.

Following is the cost of complete rewiring on a 2,000-hp. passenger locomotive equipped with two diesel engines.

Labor

Low voltage wiring	1,060 hr.	$2,120.20
High voltage wiring	540 hr.	1,080.18
Total	1,600 hr.	$3,200.38

Material

6,000 ft. No. 12 neoprene wire	$ 228.63
500 ft. No. 10 neoprene wire	24.50
900 ft. No. 8 neoprene wire	63.50
500 ft. 1100/24	556.60
500 ft. 550/24	341.72
300 ft. 225/24	130.00
200 ft. 325/24	115.00
250 ft. 91/24	41.74
400 ft. 37/24	34.74
Total	$1,535.82

Cost of miscellaneous material	$ 150.00
Total cost of material	1,685.82
Total cost of labor	3,200.38
Total cost	$4,886.20

Great improvement, the report states, can be made in service life of wiring and reduction in cost of flashovers by removing all wires from the floor and running them overhead.

W. P. Miller, superintendent, motive power and diesels, Chicago and North Western, is chairman of the committee.

Four Basic Reasons for Flashovers

By J. K. Stotz

D.c. machines flash over for the following reasons:

1. The brush leaves the commutator for some reason, long enough to draw an arc which carries over into an area of high enough voltage between bars to sustain the arc.

2. The load on the machine exceeds the range of good commutation and again a large enough arc is drawn to be sustained between brush holders.

3. Some foreign objects bridge the space between commutator bars while the coils connected to the bars are in a strong field, causing ring *fire which may develop* into a flashover.

4. The strength of the field of the machine is reduced, relative to the armature, till the distortion in the magnetic circuit becomes excessive and bad commutation results.

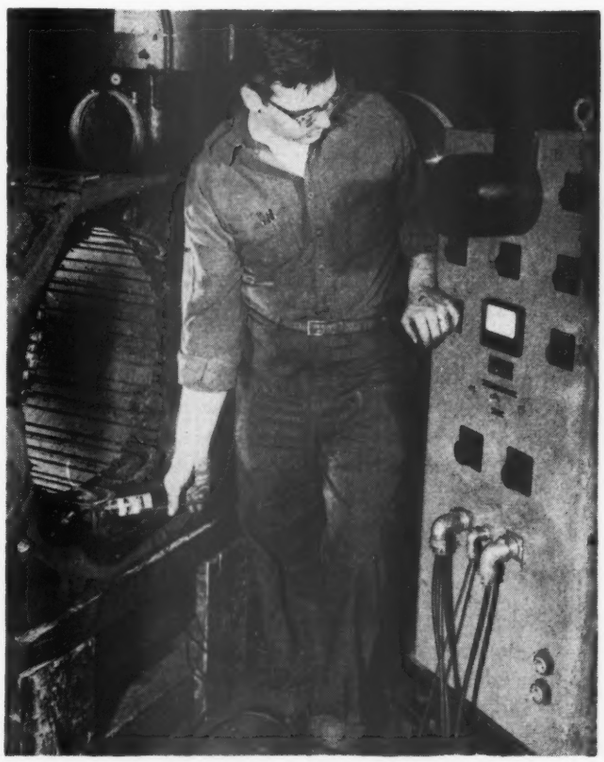
Whether any of these conditions will cause a flashover at any particular time will depend upon the severity of the condition and the inherent stability of the machine.

Item No. 1 above may be caused by, among other things, a rough commutator, too low brush pressure, stuck brushes, chattering brushes due to box wear, short brushes, or high mica. Item No. 2 is usually due to faulty control operation and, in the case of generators, to flashover of one or more motors. Item No. 3, of course, is a matter of maintenance, and Item No. 4 is also usually due to faulty control operation although sometimes field coil turns may be shorted by a previous flashover.

Good maintenance and proper operation will reduce the frequency of flashovers. However, some flashovers will occur in spite of any maintenance program. The protective devices must operate quickly enough in removing power from the equipment that the resultant damage is negligible. This is the field where the manufacturers can contribute most to the solution of the flashover problem.

The foregoing was given as discussion of the Report on Flashovers, which was presented by W. P. Miller, assistant superintendent of motive power—diesels, Chicago & North Western, at the meeting of the Locomotive Maintenance Officers Association, held in Chicago, September 14, 1953. A summary of the report appears in the October 1953 issue of *Railway Locomotives and Cars.*

Mr. Stotz is chief engineer, locomotive engineering division, Fairbanks, Morse & Co.



Traction motor stators are tested for insulation faults at the General Electric Company's Philadelphia service shop without disturbing insulation or connections by using a special pick-up coil in conjunction with a G.E. winding insulation tester.

The equipment indicates insulation faults on traction motor armatures and stators by means of an oscillograph pattern and is accurate to within 1½-in. of the exact location of the trouble.

Formerly, when it was known that a stator or armature had a fault, it was necessary to tear down the part until it was located. According to engineers at the G.E. shop, the insulation testing equipment does the job more quickly with a great degree of accuracy and ease. The apparatus also is used for high potential testing, commutator bar shorts and grounds testing, bar-to-bar tests on the commutator, and surge testing.

Truck Disassembled in 30 Minutes

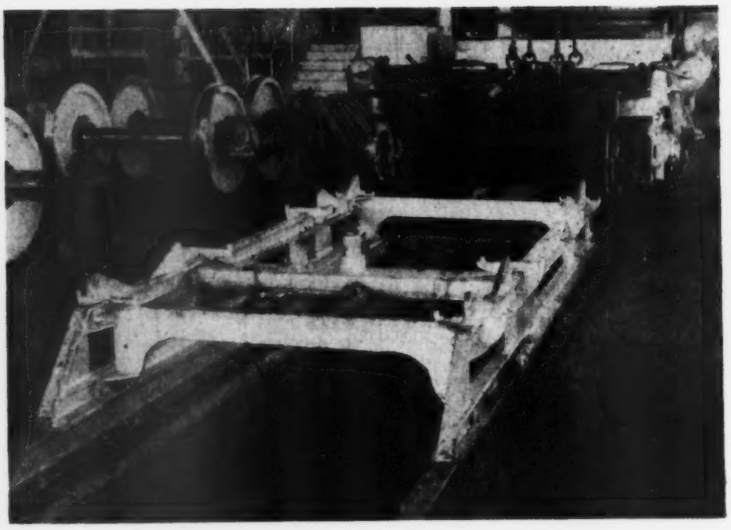


Fig. 1 (above)—The frame when in service is placed on one of the pit tracks.

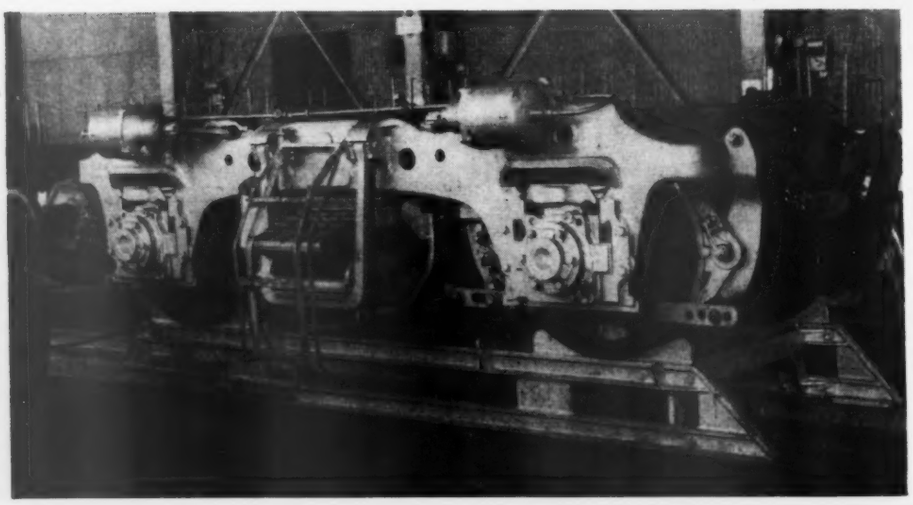


Fig. 2 (left)—A diesel locomotive truck on the frame ready for disassembly.

Fig. 3 (below)—Hand-operated jacks mounted as shown are used to compress the motor nose springs.

Special frame developed in the Barstow, Cal., shops of the Santa Fe permits fast and safe removal of diesel locomotive truck frames from wheels and motors

THE Atchison, Topeka & Santa Fe has in service in its Barstow, Cal., shops a steel frame for holding diesel locomotive trucks for either assembly or disassembly. Fabricated from steel shapes by welding, it is made to fit on the rails over a shop pit. There are curved pockets at each end of the frame which fit the contour of the wheels and which are spaced to match the distance between wheels.

When a truck frame is to be removed from the wheels and motors, a crane is used to place the frame on the pit tracks, and the truck on the frame, as shown in Fig. 2. In this position, the lower rims of the wheels are elevated about 15 in. above the floor, permitting the removal or application of the nuts on the binders under the journal boxes with an impact wrench. Binder bars are also readily accessible, a low platform in the pit being used to supply necessary height for men working underneath.

The ladder on the side of the truck frame, Fig. 2, is an aid for men in getting to the top of the truck to work on the center casting and on top pins in the brake hangers and to apply or remove crane slings.

Hand-operated hydraulic jacks, built into the frame,

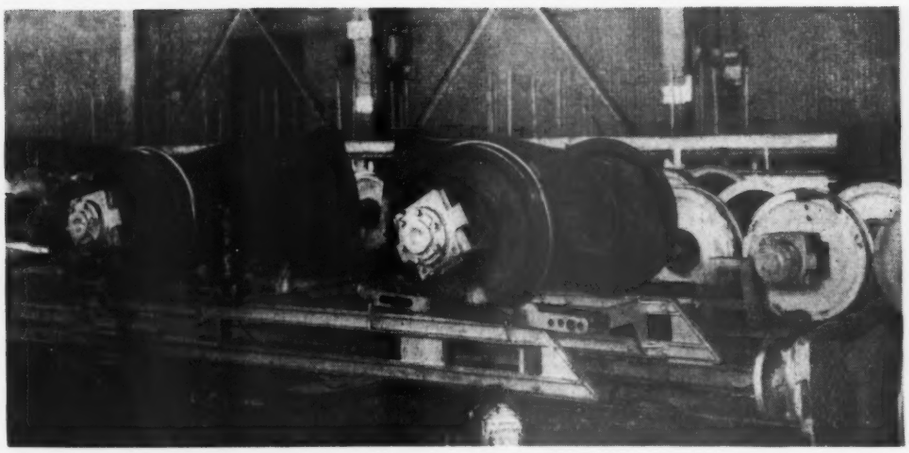
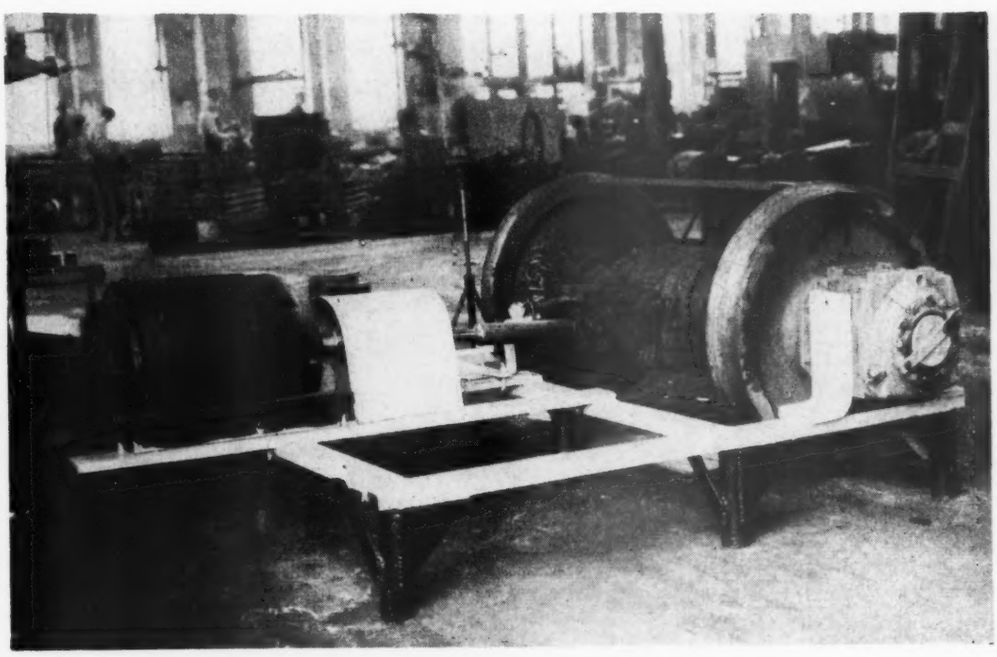


Fig. 4—Wheels and motors after the truck frame has been lifted off. Stiff legs, one of which may be seen at the left are used to keep the motor nose from dropping down.

are used to lift the motor nose, and compress the nose springs. One of the jacks is shown in Fig. 3. When the springs are compressed, split washers, ¾-in. thick, having knurled handles, are inserted between the head of the spring bolts and the top support bar. The jack is then released, and the spring assembly removed. The jacks provide an accurate, and safe method of compressing the nose springs and avoid tying up the crane for this part of the operation.

After the nose springs are removed, the truck frame is free to be removed, and is lifted off the wheels as shown in Fig. 4. This picture was taken just 30 minutes after Fig. 2. Four men were used to do the work.

Trucks may be assembled in the same length of time.

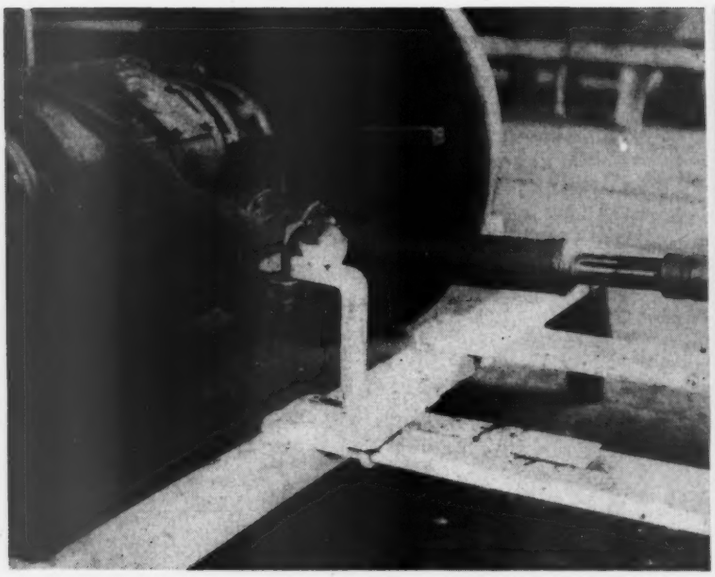


The Spicer drive test stand showing method of mounting motor and one of the bearing pedestals.

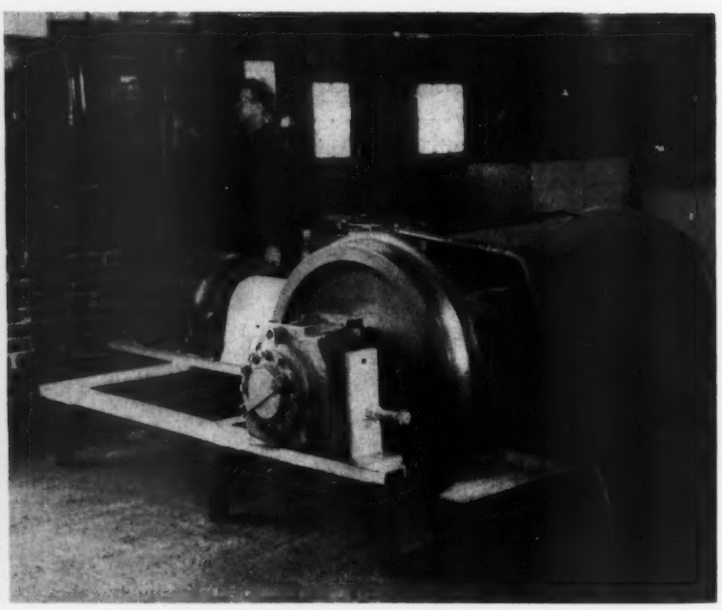
Spicer Drive Test Stand

The Union Pacific has developed a means of testing Spicer axle generator drive which insures accurate alignment and eliminates vibration. The drives to be tested are removed from the car and placed on a test stand with their own journal and wheels. A 15-hp., 220-volt, 3-phase, a.c. motor is mounted on the stand in the same relative position as the axle generator and is used to drive the axle through the splined shaft and gear. The motor runs at 900 r.p.m., and drives the wheels through a 71/23 gear ratio at a speed corresponding to about 50 m.p.h.

When the wheels and gears are brought into the shop, they are cleaned and immediately placed on the test stands. The stand is fabricated by welding from 4-in. x 1¾-in. channel and 1-in. x 3-in. flat steel, and is supported on sections of 3-in. pipe thread with angle braces. The horizontal members which support the journal boxes are 13 in. above the floor The pedestal jaws are welded to the horizontal members, and are spaced far enough apart to accommodate any size of box. A 1-in. by 8-in. cap



Left: An adjustable bracket, clamped to the test stand provides the necessary torque arm support. Right: Wm. J. Matson places the dial gage against a drive housing.



Left: The dial gage as applied against one end of the drive housing. Right: The drive in operation with guards in place.

screw, threaded through one of the jaws and fastened with a locknut, secures the box in position. An adjustable bracket to hold the torque arm is clamped to the stand. When the drive is placed, measurements for lateral clearance on each side are taken to insure that the drive is centered.

The first operation consists of running the drive at speed to check vibration. In all cases, a dial gage is used to determine how much the gear is out of line with the axle. The manner in which it is used is shown in two of the illustrations. The gage is mounted on a tripod which stands on the floor. The tripod is placed so that the gage contact just touches the back of the housing at one end. Then the wheels are turned by hand and the movement of the gage noted. The same operation is also performed at the opposite end of the housing.

Any excessive movement of the housing is corrected. Rubber axle bushings are shimmed between the two halves, or renewed if necessary. Lateral movement of the housing as shown by the gage is removed by tightening the compression rings which clamp the bushings to the axle. Releasing on one side and tightening on the other will reduce or increase the movement of the dial indicator.

Screw jacks between the wheel hub and compression ring cap screws prevent lateral movement of the drive during the adjustment. When finished the movement as shown by the gage will be between 0.001 and 0.004 in.

Since this procedure has been followed, the number of torque arm bushings used has decreased about 60 per cent. A record is kept of the drive serial number, date of overhaul, and a list of any new parts applied. Nearly all of the original drives are in service, some of them having run for more than 1,000,000 miles.

DIESEL-ELECTRICS—How to Keep 'Em Rolling

21 Dynamic Braking

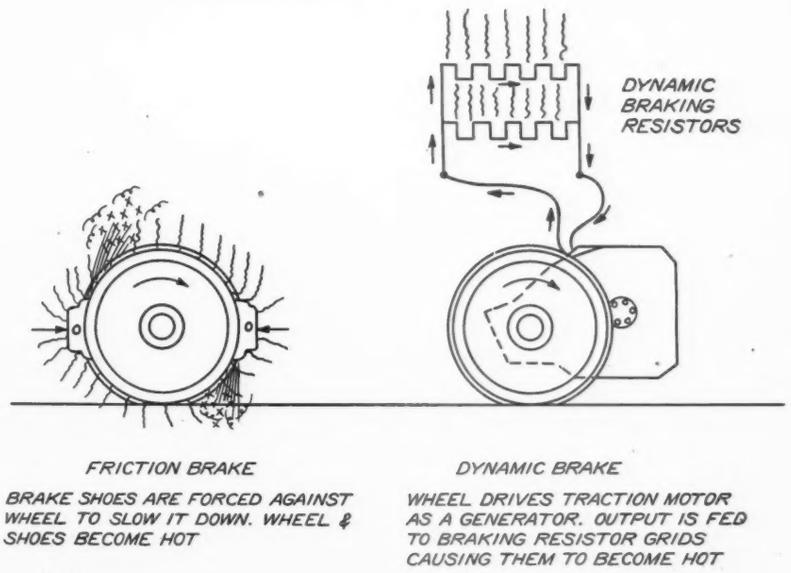


Fig. 1—Friction and dynamic braking compared.

RAILROAD legend says the wreck of the old 97 was caused by a brake failure. That's usually the way a brake failure ends. Fortunately such failures are so rare today that we take the brakes on a train almost for granted. But a very important part of the locomotive's job is supplying the means for braking the train. Steamers use compressed air for this. They have an automatic valve to apply brakes to the locomotive and train, and an independent valve to apply brakes to the locomotive only.

Something New

When diesel electrics came along, they had air brakes like the steamers. Some of them also had another type of brake called the rheostatic dynamic brake. The electric motors used to power the locomotive made this possible. The dynamic brake is much like the independent air brake since it brakes the locomotive only.

The use of locomotive motors for braking is really not new. Electric locomotives have been doing it for years. On them, it is called regenerative braking. In both regenerative and rheostatic dynamic braking the traction motors act as generators. In regenerative dynamic braking, the current is pumped back into the overhead power line. In rheostatic dynamic braking, it is pumped into braking resistors which are carried on the locomotive. Generally, the rheostatic system used on diesel-electric locomotives is spoken of as "dynamic braking." This is the name we will use.

How It Works

Let's see how traction motors are used for dynamic braking on diesels. In Fig. 1 (a) you see the action of brake shoes against a wheel. As they grip the wheel, they tend to stop it from turning. The friction between the shoes and wheel produces heat. In fact, both shoes and wheel will get quite hot if heavy braking is applied for a long time. The rubbing also wears both the shoes and the wheel.

In Fig. 1 (b), you see the action of a wheel with dynamic braking. The momentum of the train turns the wheel. This drives the traction motor as a generator and forces current through the braking resistors as shown by the arrows. The resistors heat up just like your electric toaster. The traction motor, working as a generator, resists the turning of the wheel and tends to stop it. So we are using the motor to do the same thing as the brake shoes. Now, it is the braking resistor and motor instead of the brake shoes and wheel that get hot. So, they must

This is the twenty-first of a series of articles on the maintenance of diesel-electric equipment. This article is written by B. L. Judy and A. V. Johansson, both of the Locomotive and Car Equipment Department, General Electric Company, Erie, Pa.

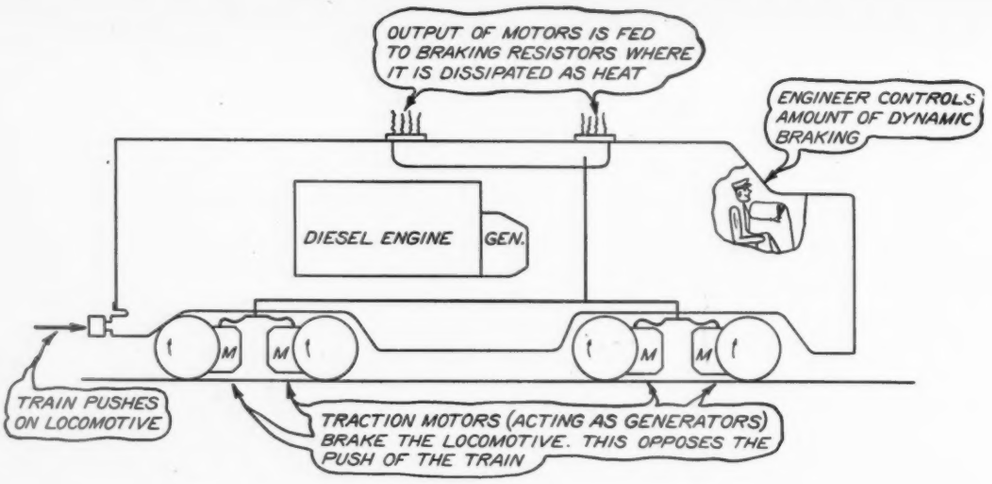


Fig. 2—Dynamic braking applied to a four motor diesel-electric locomotive unit.

be cooled by blowers. The wheels and brake shoes do not wear because there is no rubbing.

To have dynamic braking the wheel must be turning. This is because a generator generates only when it is turning. You know this from the fact that you can't get anything out of the main generator when the diesel engine is shut down. In the same way, you can't get anything out of the motors when they aren't turning. So dynamic braking cannot be used to hold a stopped train. You still have to use air for this. On the other hand, if a wheel starts to slip with dynamic braking you will lose much of the braking until the wheel stops slipping. Because of this, you can't put "flats" on wheels with dynamic braking alone.

In Fig. 2, you see how dynamic braking on a four-motor locomotive works. The momentum of the train pushes the locomotive and turns the wheels which drive the motors. The output of the motors is fed into the braking resistors. The engineer controls the braking by moving the selector handle. A loadmeter shows him how much braking current he is getting.

Motors as Generators

Now let's see how a motor is used for dynamic braking. At the beginning of this series, we learned that a d.c. machine could be used as either a motor or a generator. It is simply a matter of how it is connected. Let's take a look at Fig. 3. To be simple, this shows just one motor.

In Fig. 3 (a) you see the motoring connections. Current is being pumped through the motor armature and field by the generator. This causes the motor to turn and move the locomotive.

In Fig. 3 (b) two switches have been thrown to change the motor connections. Now the generator pumps current through the motor field only. Two things happened to the armature: (1) it was cut off from the generator; (2) it was connected across the braking resistor. Now we have separated the motor field from its armature and are pumping current through the field only. If the locomotive is moving, the wheels are turning and driving the armature. It is connected across a resistor so that it has a load. Here is all that is needed for a generator set-up. In elec-

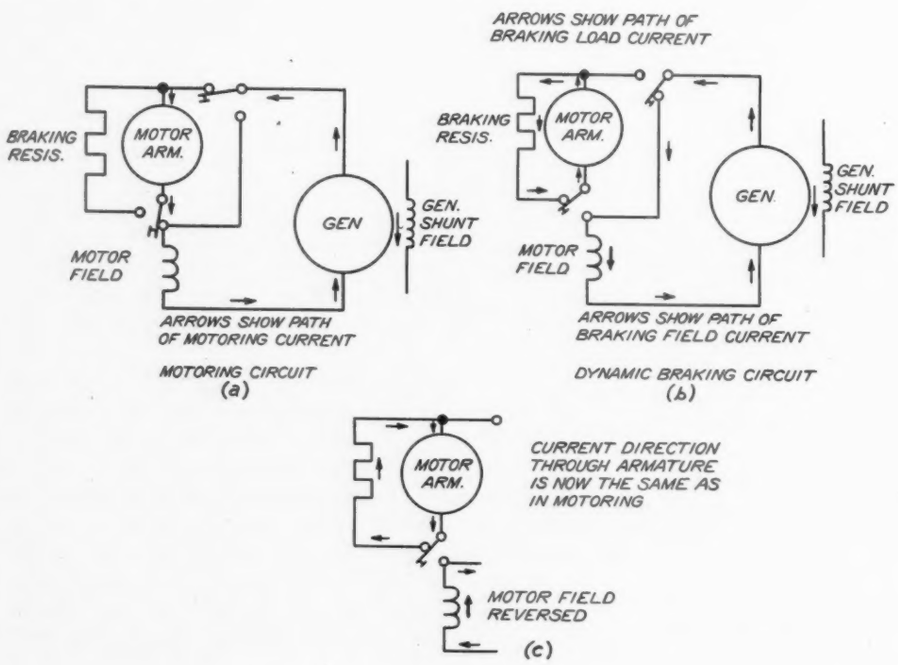


Fig. 3—Circuit sketches showing how a traction motor can be used for dynamic braking.

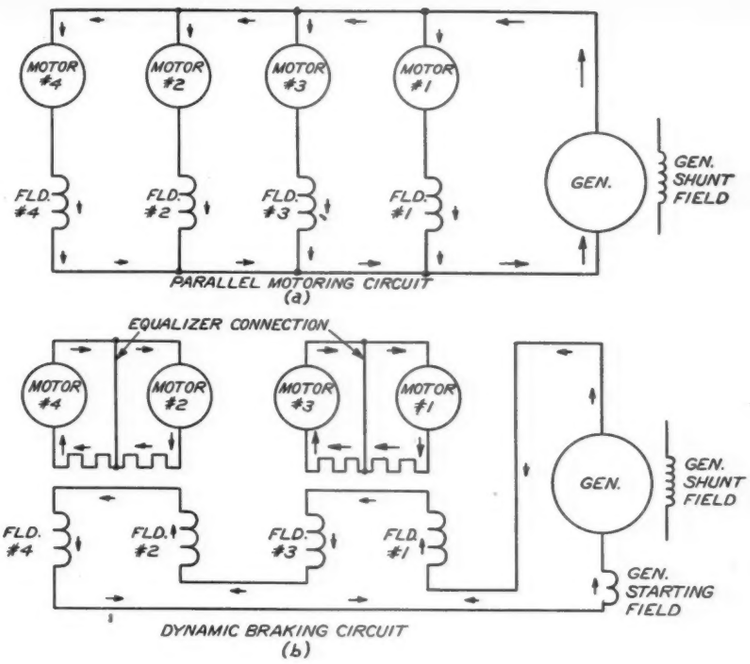


Fig. 4—Simplied diagram of motoring and braking circuits on a four-motor locomotive.

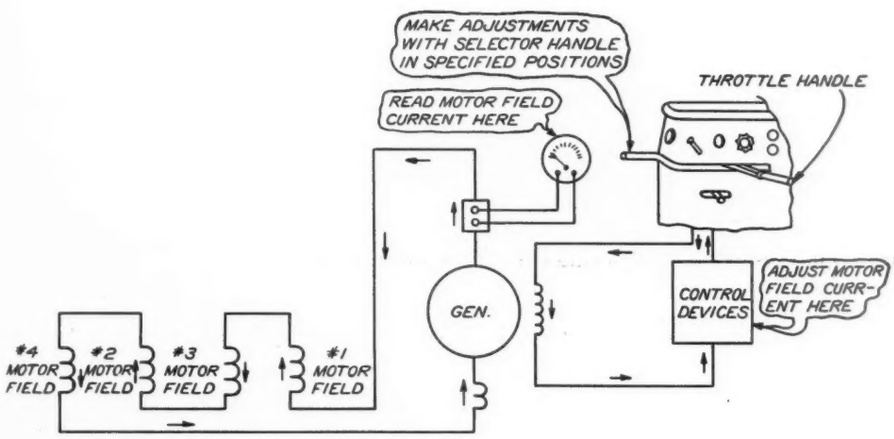


Fig. 5—Suggested connections to be used when adjusting dynamic braking in the shop.

trical language, we have a separately excited generator with a resistance load.

If you look at the arrows in Fig. 3 (b) you will see that the field current is flowing in the same direction as it was in (a). But the armature current is reversed in (b). If we reverse the field current, Fig. 3 (c), the armature current will flow in the same direction as in motoring (a). Let's make this easy to remember—when you change from motoring to braking if the field current stays the same, the braking current will reverse. If the field current is reversed, the braking current will stay the same. We'll see how this comes in handy when we get to a four-motor set-up.

Here are some things about the circuit in Fig. 3 that you should know to understand dynamic braking.

1. The more current you put through the motor field (within certain limits) the more braking current you will get.

2. The lower the braking resistance the higher the braking current. (This resistance is fixed when the locomotive is built, so you don't have to worry about it.)

3. The faster the armature turns the higher the braking current.

4. The higher the braking current the more braking you get.

Braking Control

The key to controlling the output of almost any generator is its field. In this case, it is the traction motor field. Look at Fig. 3 and you will see how it can be controlled. The main generator supplies the current for this field. In a previous article we saw how the main generator output is controlled in motoring. The same control is used for braking, but the generator is connected to the motor field only. By controlling this, we control the dynamic braking current. The engineer does this by moving the selector handle.

For example, at high train speed you need a weak motor field to hold the braking current to a reasonable value. This calls for a small main generator output. The engineer gets this by moving the selector handle just into the braking sector. At low speed, you need a strong motor field to get full braking current. He gets this by moving the selector handle further into the braking sector. He can get the amount of braking he wants for any speed by moving the selector handle.

Four-Motor Circuits

Most diesel-electric locomotive units have four traction motors. The motoring and braking circuits for such a locomotive are shown in Fig. 4. To make it simple the switches and contactors have been left out. A braking switch much like the reverser is used to set up these circuits. As you see, the four-motor set-up is about the same as the one-motor set-up just covered.

The motor armatures work in pairs—*1* and *3* together, and *2* and *4* together. The braking current flows around through the motor armatures and their braking resistors, as shown by the arrows. Normally no current flows through the equalizers. They are there to carry current when a wheel slips. If they weren't there it might be possible for the slipping wheel to be driven as a motor by the other motor.

All of the motor fields are connected in series and fed from the main generator. The current through *1* and *2* motor fields is reversed from motoring. The current through *3* and *4* motor fields is the same as in motoring. So the current through their armatures is reversed from motoring. This arrangement uses the least number of switches to change from motoring to braking.

The generator starting field is used in the braking circuit of Fig. 4. You may wonder why. Here is the reason. The main generator load is very light in braking. In fact it takes only about 40 volts to get maximum braking current. In motoring, on the other hand, the generator has to develop as high as 800 to 900 volts. So, even though the engine runs at idling speed in braking, the generator voltage would be too high. If the shunt field were cut down enough to give the low voltage needed, the generator would tend to be unstable. Instead, the braking current is put through the starting field in a direction that opposes the shunt field. This pulls down the generator field so that it gives the low voltage required for braking. (You could say that the starting field acts as a differential field in the braking circuit.)

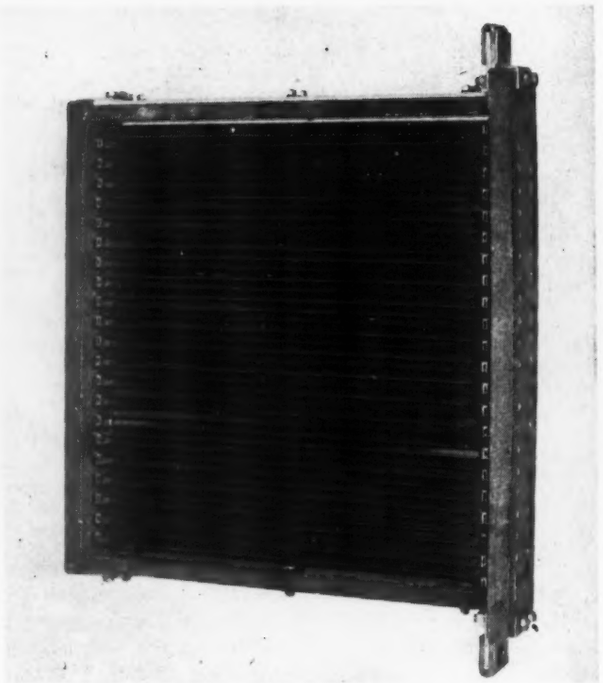


Fig. 6 (above)—Ribbon-type resistor unit used on one kind of dynamic braking resistor.

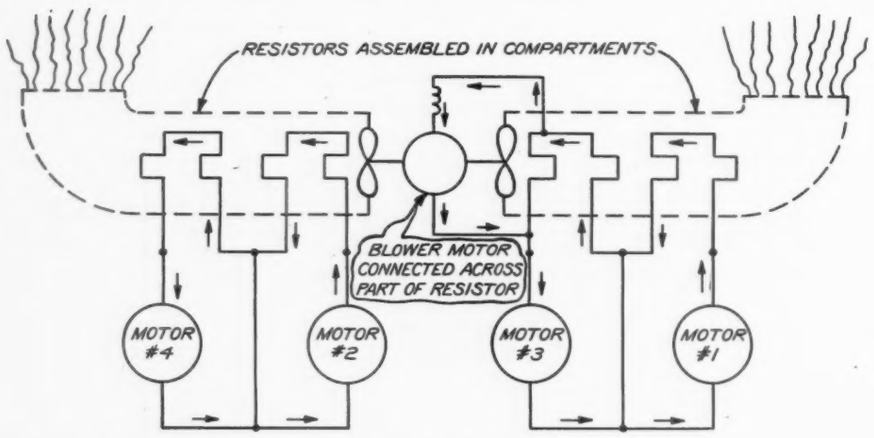


Fig. 7 (left)—Dynamic braking circuits on a four-motor locomotive showing how blower is connected. The diagram shows the arrangement of braking resistors and cooling fan.

Adjustments

The current through the traction motor fields determines the braking current. The engineer controls this field current by moving the selector handle back and forth in the braking sector. He reads the braking current—which is really motor armature current—on the loadmeter. Of course, braking current flows only when the locomotive is moving. This means you have a problem. You would like to make adjustments to the dynamic braking in the shop. But with the locomotive standing still you won't get any loadmeter reading. Let's take a look at Fig. 4 (b) and see how you can get around this.

The four motor fields are connected in series and fed from the main generator. As you've already learned, these fields are just copper coils bolted to the motor frames. You can think of them as plain resistors. For any given position of the selector handle the current through these coils will be the same, whether the locomotive is speeding down the track or standing in the shop. So you can make your adjustments in the shop by reading the field current.

In making the adjustment you want to get the braking field current to agree with the selector handle position. When the handle is in the big "B" you want least field current. When it is shoved around to full brake you want most field current. It's much like adjusting the brakes on your auto. A touch on the pedal gives you a light brake. If you push it all the way down you get full brake. Since

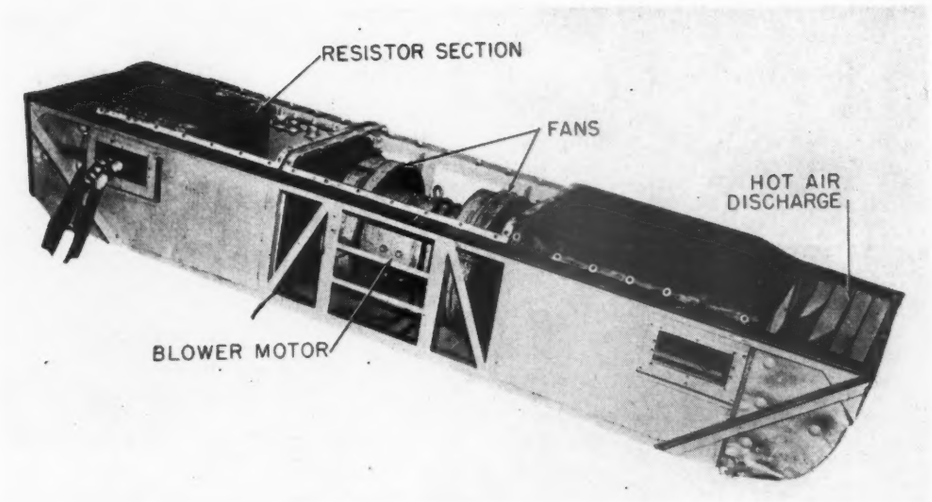
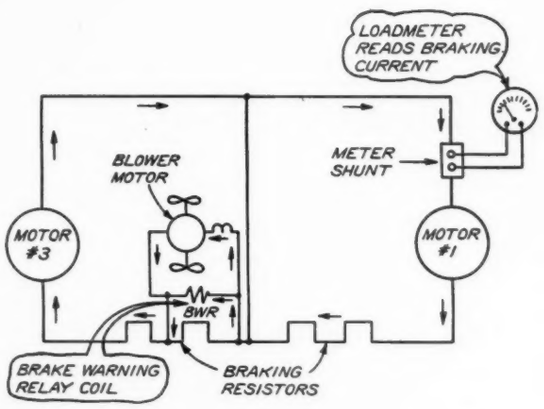


Fig. 8 — Assembled dynamic braking resistor as installed on Alco-G.E. locomotives.



BRAKING CIRCUIT FOR MOTOR ARMATURES 1 & 3 SHOWING ASSOCIATED DEVICES

Fig. 9—How the braking current is read, and connections of the brake warning relay.

dynamic brakes do not wear out like those on your car, they do not need to be adjusted often.

To adjust the dynamic brakes you will have to connect a meter somewhere in the motor field circuit so you can read the field current. One way to do this is shown in Fig. 5. You can also measure this current by measuring the voltage drop across the generator commutating field or armature. Be sure that the engine speed is correct for braking and steady before you take your readings. Since the main generator supplies the motor field current, you make the adjustment in its field circuit. To do this, put the selector handle in big "B" and adjust to get a given current reading. Shove the handle around to full brake and adjust to get a second reading. Your instruction book will give the exact set-up and readings for your particular locomotive.

Protection

So far not much has been said about the braking resistors. They are a little different than the ones we normally think of in locomotive circuits. Since they have a big job to do in absorbing the push of a moving train, they are man-sized (Fig. 6).

The capacity of a resistor is limited by the amount of heat it can take. If it gets too hot, the metal wire or ribbon of which it is made will melt. One way of preventing this is to blow it with air. As you see in Fig. 7, a fan is used for this. The resistor sections are stacked in a tunnel or compartment so the air can be forced through them and out the roof.

Normally, we would have to supply power to drive the fan. In this case, though, we are trying to get rid of the power generated by the traction motors. That's why we have the braking resistor. So we just tap off part of the current that would otherwise go through one of the sections and put it through the fan motor. In this way, we can run the fan on waste power. Another advantage is that no control is required. With no braking current there is nothing to run the fan. As the braking current goes up, so does the fan speed. Thus it operates automatically to cool the resistors as needed. If you ever need to run the fan in the shop, you can run it from a welding set.

The grids themselves are made of thin metal ribbon with plenty of space to let the air through. If they were of the old-fashioned cast iron type and were not blown, it would take a box car to carry enough of them for one three-unit locomotive! The grids and blower that are used on the Alco-G.E. locomotive are shown in Fig. 8. The assembly is about the size of a large bath tub.

These resistors, like any others, will overheat if too much current is put through them. The engineer can read this current by watching the braking scale on his loadmeter. This reads the current in the *1* and *3* motor armature circuit, as shown in Fig. 9.

An alarm bell and a light warn the engineer if the braking current goes too high. These are operated by the brake warning relay (*BWR*, Fig. 9). Its coil is connected across the same section of resistor as the blower motor. If the current gets too high, the relay will pick up and give the alarm. In multiple unit operation, the engineer can see only one loadmeter. So the *BWR* relay is connected to the train line circuits. This means that too much braking current in any unit will give a warning in the lead unit. The engineer must reduce braking current by backing off on the selector handle until the warning stops.

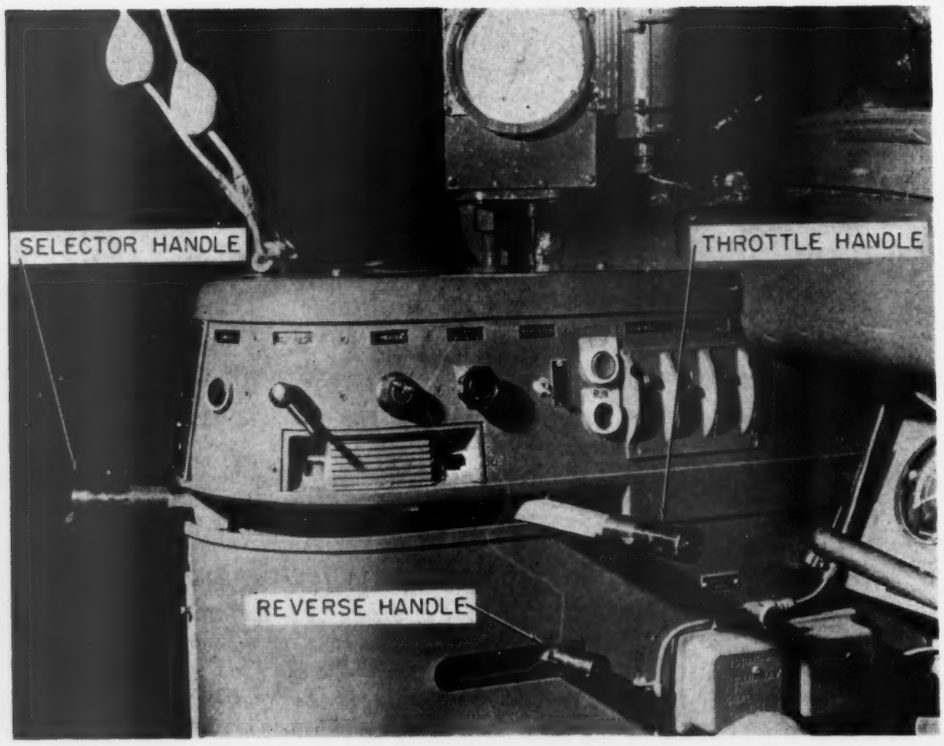


Fig. 10 (left)—Controls at the engineer's position on an Alco-G.E. locomotive, showing dynamic braking selector handle.

Fig. 11 (below)—How dynamic braking varies with train speed, and the important points the engineer needs to note on the load meter.

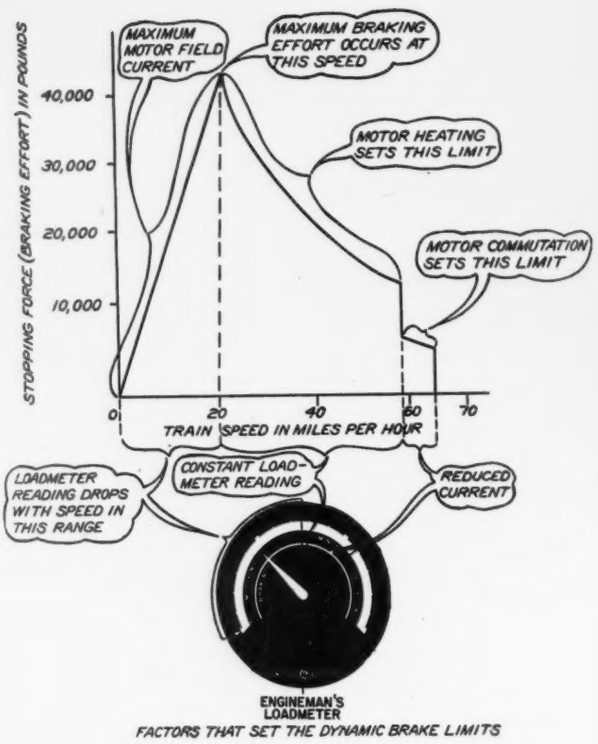
Since the *BWR* relay guards the braking grids, it should be kept in good condition. Look at it now and then to see that it will operate and that the alarms ring. If you suspect trouble or find warped grids, check the calibration of the relay.

Braking resistors will usually require little attention. Dirt and water in the resistor compartment are the biggest sources of trouble. This compartment is fairly open to the outside so the cooling air can escape. This means it is easy for dirt and rain to enter. Drains are provided to carry off the water. In time dirt may stop these up. Then water can't run off and you will usually be plagued with grounds in the resistors. Periodic cleaning of the drains and resistor compartment will prevent this. How often you do this will depend upon operating conditions.

Dynamic Brake Characteristics

The first job of the traction motors is to drive the locomotive. They are designed for this. When they are used for dynamic braking, we have to take what we can from them. So we don't get exactly the braking we would like at all train speeds. Instead we take all we can get from the motors at all train speeds and accept a brake that changes with speed as shown in Fig. 11. The values on this chart do not apply to any particular locomotive. They do give a rough idea of the braking force for a typical locomotive over its speed range.

You will notice that as the train begins to slow down from high speed, the stopping force goes up. It reaches a peak at about 20 miles per hour. This is the speed where the dynamic brake is most effective. As the speed drops below 20 miles per hour, the braking force lessens. At standstill, you get no braking. At the top speed end of the curve you will notice a notch, of reduced braking. Full braking current at top speed would cause considerable sparking on the motor commutators. This might damage them, so the braking current is reduced. The speeds at which reduced braking is required are given in the operating instructions for each locomotive. A mark on the braking scale of the loadmeter shows the reduction required.

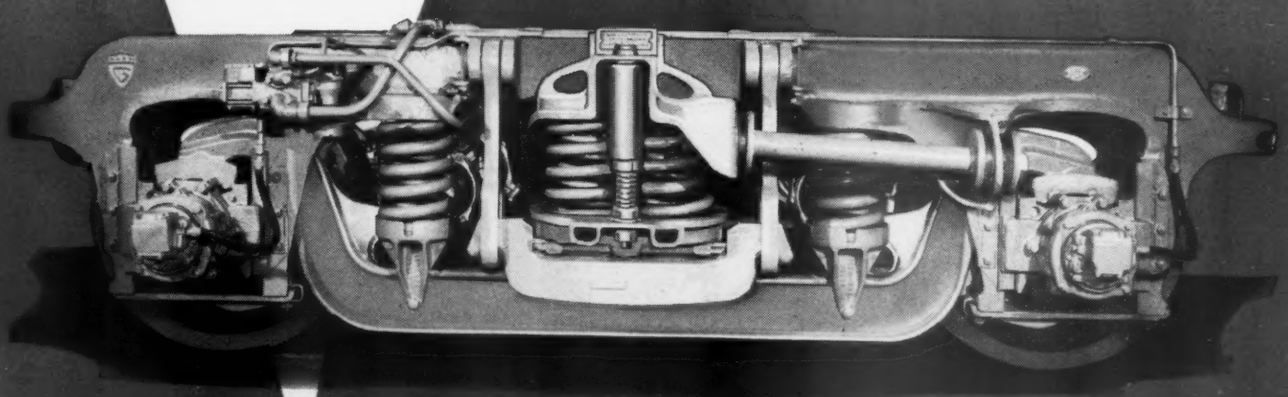


FACTORS THAT SET THE DYNAMIC BRAKE LIMITS

Automatic Current Limit

To get maximum braking the engineer must keep the braking current constant by adjusting the selector handle

It's a Fact!



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as train speed changes. Some locomotives now have automatic control of this current. On these locomotives dynamic braking is applied and removed in exactly the same way as on non-automatic units. However, the selector handle can be cautiously moved to the full braking positions and the control will then automatically hold full braking cuurent over the speed range. This is done by means of control that takes a signal from the braking current and uses it to regulate the main generator shunt field current. So, instead of the engineer having to watch the load meter and regulate the braking current, the control system does it for him.

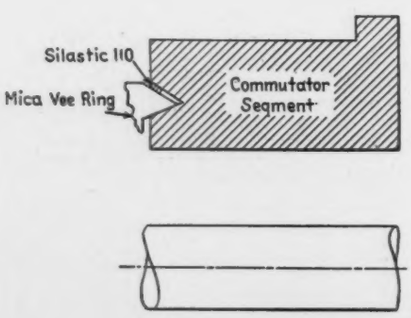
Automatic and non-automatic units can be operated together. With some types, the current is limited on the automatic unit only. Then the brake warning relay (*BWR*) must be relied upon to tell when the non-automatic trailing units are being overloaded. It also warns of overload on the automatic units if the current limit control is out of adjustment. Thus, even on a locomotive with automatic control, the *BWR* is important. So the smart thing is to keep it in good condition at all times.

Dynamic braking adds very little control equipment to a locomotive. Yet, it is an important operating asset, especially on mountain grades. Inspection and maintenance of most of the equipment have been dealt with in previous chapters. The few added parts have been covered here. But, though they are not many, they are important. The alert maintainer will find it easy to check these items quickly. Careful attention to them will pay off in dependable dynamic brake operation—and that's important in any man's language.

Vee-Ring Seal

One of the manufacturers of diesel-electric locomotives has recently adopted Silastic paste for sealing the Vee rings on the arch-bound commutators of its traction motors. On this type of commutator, only the inner side of the mica Vee ring bears against the communtator bars, leaving a space between the outer surface of the ring and the bars. The paste is used to fill and seal this space.

Silastic Paste 110 was chosen for this purpose. It is applied to the Vee-ring before it is assembled into the commutator. When the ring is put in place, the paste is forced out, the excess being smoothed off with a trowel. To cure the paste, the commutator is baked for six hours at a temperature of 170 deg. C., which is also the manufacturer's regular seasoning temperature. After curing, the commutator is put through the seasoning cycle.



Although the indicating thermometer and the device being tested are in different parts of the tank, their temperatures are the same.

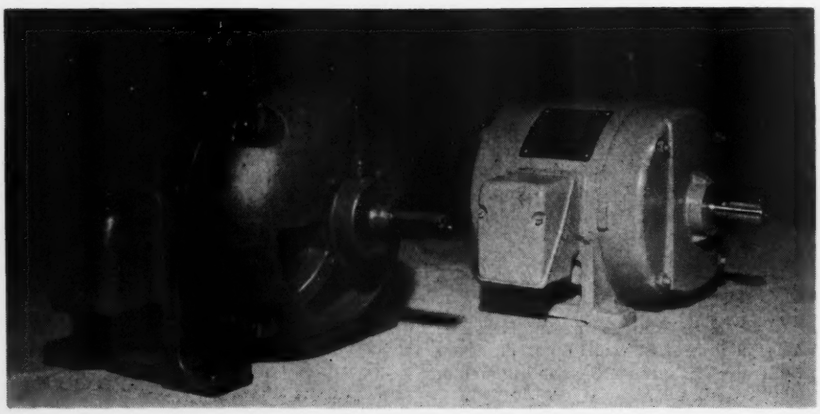
Takes the Guess Out Of Thermal Switch Testing

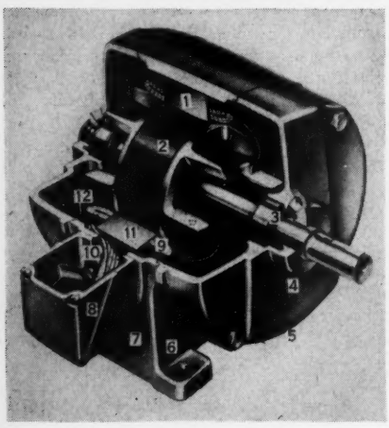
Welded to the shop-fabricated table shown in the illustration is an arrangement of equipment used by the Seaboard Air Line for testing diesel-electric locomotive temperature switches and shutter controls.

The basic requirement for such testing is an accurate means for bringing the devices to be tested up to a certain temperature. It is also necessary to hold that temperature long enough to insure proper operation of the devices. The usual method used consists of heating a container of water by putting a flame under it and putting the switches and thermal controls in this water. Holding the water temperature constant by this means is difficult and the temperatures in different parts of the container may not be the same.

The apparatus on the table includes a fuel pump, an electric immersion heater operating from a 220-volt a.c. circuit, and a vertical cylindrical water tank to which is fitted a temperature gage. The device to be tested is either applied to the tank by a pipe fitting or is dipped into the top of the tank. The system is filled with water which is heated by the immersion heater and circulated through the heater and the tank by the pump. The heater provides an accurate means of heating the water and the circulation insures that the temperature in all parts of the tank is the same. The temperature gage in the side of the tank shows the temperature at which the device under test operates.

NEW DEVICES





New Line of Polyphase Motors

A new line of polyphase a.c. motors, offering better protection, more efficiency, and quieter operation has been announced by the General Electric Company's Small Integral and Medium Induction Motor Departments, Schenectady, N. Y.

Called Tri-Clad 55, the motors are built to standard N.E.M.A. frame dimensions and feature a number of improvements of design.

With an average size reduction of 50 per cent by volume and averaging 22 per cent less weight per horsepower, the motor retains rigid cast-iron construction and incorporates a new insulation system, bearing assembly, and ventilation plan.

The insulation incorporates a polyester film which is said to be eight times as strong as previously used materials. It is used to insulate the phases and slot tubes in the stator—the points of hardest motor wear. This synthetic material, combined with Formex wire, an improved Glyptal varnish, and a silicon Dri-film dip, has effectively withstood accelerated life tests and salt-spray tests.

The bearing assembly is more tightly sealed than that of previous designs and is lubricated by a grease which tests indicate will last at least five times longer than formerly used lubricants. A double-end ventilation system uniformly cools the motor by drawing air in from beneath both endshields, through baffled air passages, and out louvers on the sides of the frame. Larger integrally-cast rotor fans increase the cooling air flow through the motor and dissipate rotor heat more effectively. Protection has been increased on the dip-proof enclosure through new end-shield and frame design.

A major part of the new motor design involves noise levels. According to G.E. engineers, the noise level of the 10-hp. motor tests as low as the former 2-hp. model.

The totally-enclosed fan-cooled motor also has been redesigned. Electrical parts are completely enclosed by a tightly sealed cast-iron frame and end shields, a compression-fit lead seal, and a rotating labyrinth seal on the shaft. The ventilation system blankets the frame with cooling air. Plastic fan, stainless steel nameplate, and other exposed parts are corrosion-resistant.

Other improved maintenance features include permanently-numbered, non-wicking connection leads, a larger diagonally-split conduit box, knock-off lugs on the end shields, and location of the combination nameplate-connection diagram directly over the box.

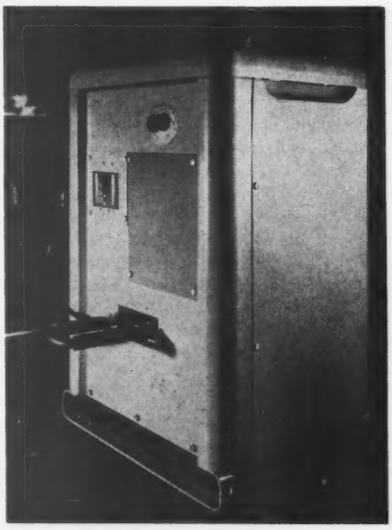
After the first of the year, the new motors will be available in 182 and 184 frame sizes (1, 1½, and 2 hp. at 1,800 r.p.m.) in horizontal drip-proof and totally-enclosed fan-cooled models, and a complete line of gear-motors. Larger frame sizes will become available at regular intervals.

Other types planned for production during 1954 include vertical, single-phase, wound-rotor, explosion-proof, multi-speed, face-mounted, and flange-mounted models.

The numbers in the illustration showing the cut-away section correspond respectively with:

1. Polyester film slot and phase insulation
2. Solid-cast rotor windings
3. Sealed bearing system
4. Protected end shields
5. Shaft-end air intake of double-end ventilation system
6. Rigid cast-iron construction
7. Louvered ventilation exhaust
8. Conduit box
9. Stator windings
10. Permanently numbered leads
11. Press-fitted stator punchings
12. Sonance designed ventilation baffle

■



Selenium Rectifier D.C. Arc Welder

A selenium rectifier d.c. arc welder has been developed by the Westinghouse Electric Corporation, East Pittsburgh, Pa., that incorporates the characteristic advantages of static, plate-type rectifiers with less weight and size, and according to the manufacturer, with greater ease of maintenance and wider versatility and user convenience.

Consisting essentially of two parts, the welder is made up of a three-phase, full-wave selenium rectifier, and of a so-called Transactor unit, which is a combination three-phase transformer and movable core reactor. The Transactor unit has resulted in a smaller, lighter, more convenient current control and voltage step down device. It has two, three-phase laminated cores. One is a fixed core on which the primary and secondary coils are wound. The other is divided into two parts—a stationary core, and a movable core. The legs of the movable core are linked by the common secondary and reactor winding.

The movable core is supported by guides on the welder side members. Two acme screws supported by the stationary core section drive the movable core by means of a hand crank on top of the welder. Current is controlled by moving the core section in and out of the Transactor unit coils. When the movable core is at a maximum distance from the stationary core, the welder output current is maximum. Minimum current is obtained when the movable core is close to the stationary core.

Coils are made of aluminum. Glass-covered, Glass B insulated aluminum conductors have made this possible. The Transactor unit construction has eliminated the internal connections that would be necessary to tie transformer and reactor together if they were two separate units. Crimp-type copper terminals are used for coil end connections. A special compound is used between the aluminum conductors and copper terminal to insure low contact resistance for the life of the unit. The aluminum coils reduce coil weight by a ratio of about 2 to 1.

Through the use of aluminum for Transactor unit coils and other design modifications, the weight of the units has been reduced, for instance, from 510 lb. to 400 lb. on a 300-amp. welder.

Axial flow ventilation is used on the new welder with the fan located in the top of the unit and the air intake located at the bottom. The upward flow of air follows natural convection and results in maximum cooling with minimum size cooling fan and motor.

The three standard units of this welder are of the 200-, 300-, and 400-amp. sizes and duplex models are available in 300/600- and 400/800-amp. ratings.

The manufacturer states that the efficiency at rated load for a 300-amp. welder is 66 per cent as compared to 54 per cent for an average motor-generator welder. The power factor, at normal operating load conditions is comparable to induction motor-driven welders.

■

Spring Wire Connectors

Two new sizes of the "Scotchlock" electrical spring connector for making splices in electrical wiring have been introduced by Minnesota Mining and Manufacturing Company, St. Paul, Minn.

They are a spring-type connector which makes a small size joint, which can be applied without tools and which is kept from

shaking loose by the spring which is screwed onto the wires to make the connection.

With the addition of Type L (large) and Type S (small) to the medium size connectors previously in service, the connectors can be used on all wire sizes ranging from No. 6 to No. 18 A.W.G., either solid wire or stranded, in several hundred combinations.

They are designed for making splices in circuit wiring and for fixture hanging and appliance hook-up. Made of zinc-plated steel wire in the form of a tapered coil spring, the lubricated connectors are easily

(*Continued on page 122*)

screwed on the stripped ends of the wires with the fingers. A notched turning stem provides adequate leverage during application and is then snapped off leaving a neat splice with no sharp ends.

The coil spring allows the connector to expand while being applied, but provides a shake resistant, tension grip on the wires once the splice has been made.

The small diameter of the connector adds very little to the diameter of the wires, making it valuable for joining wires in crowded junction boxes.

Recommended insulation for use with the connectors is "Scotch" plastic electrical tape No. 33 providing water-and-oil-resistant splice. The connectors are available in boxes of 100 through electrical wholesalers selling "Scotch" brand electrical products.

■

Cell Puller for Storage Batteries

A cell-puller for removing cells from batteries for examination or repair has been developed by Gould-National Batteries, Inc., Trenton, N. J. The tool, generally used in sets of two, consists of a U-shaped steel loop brazed to a hexagonal steel nut with specially-cut threads tapering from bottom to top. The nuts are screwed down over the lead posts, a piece of wood is placed in the loops and the cell is pulled from the battery by a chain or rope. The same tool is also used with hold-down clips for removing the elements from the jar.

■

Railway Station Synthetic Paint

A high gloss, chalk resistant, exterior finish has been developed for railway station houses and freight stations. It has a lower chalk rate than standard oil base paints, thus, danger of chalk pick-up by passengers' clothes is minimized.

Manufactured by E. I. du Pont de Nemours & Company, Wilmington, Del., the finish may be brushed or sprayed onto the surface. It has a spreading rate of 500 to 600 ft. per gal. and dries to touch in 2 to 3 hr. and may be repainted or recoated afer overnight dry.

The paint may also be applied over metal, cinder block, cement and brick when a suitable primer is employed.

■

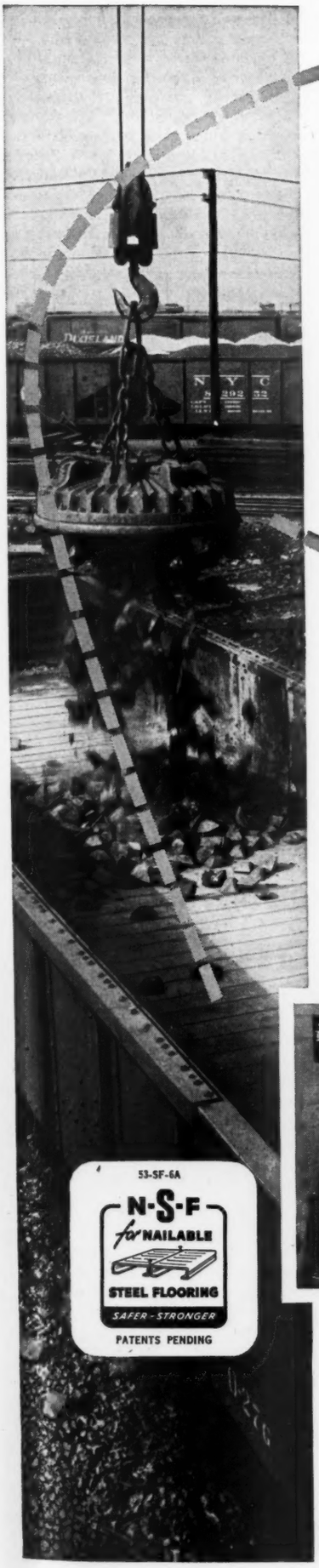
Automatic Cut-Off Bender

The automatic cut-off compression bender, developed by Pines Engineering Company, Aurora, Ill., is a unit designed for high-volume production of copper elbows and return bends. Feed, clamping, bending, cut-off and unloading operations are entirely automatic.

Two different machines and bending principles are employed. For 180 deg. return bends with little or no allowable tangent length, compression bending is used. For 45 and 90 deg. ells with longer tangent lengths, machines employing the draw bending principle are provided.

Hydraulic power is said to assure accurate uniform production results and dependable service. The units are equipped with push-button controls.

(*Turn to page 124*)



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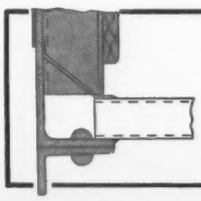
In normal service, NAILABLE STEEL FLOORING should last the life of the car. So, when you invest in N-S-F for your equipment, you have a long-term investment that keeps paying off for many years.

Not only does N-S-F provide improved floor structure but also serves to reduce stresses of impact shocks at critical points on the underframe.

And most important of all—N-S-F increases availability of boxcars and especially of gondolas. Blocked and skidded loads in these cars are held with maximum security, and the same cars can be used for bulk freight.

For better car utilization, reduced maintenance, fewer damage claims—be sure to have NAILABLE STEEL FLOORING.



Another development is the new N-S-F Metal Grain Strip to make boxcars leak- and vermin-proof.

Finished freight is securely held by N-S-F.

N-S-F provides tight, smooth flooring for bulk loads.

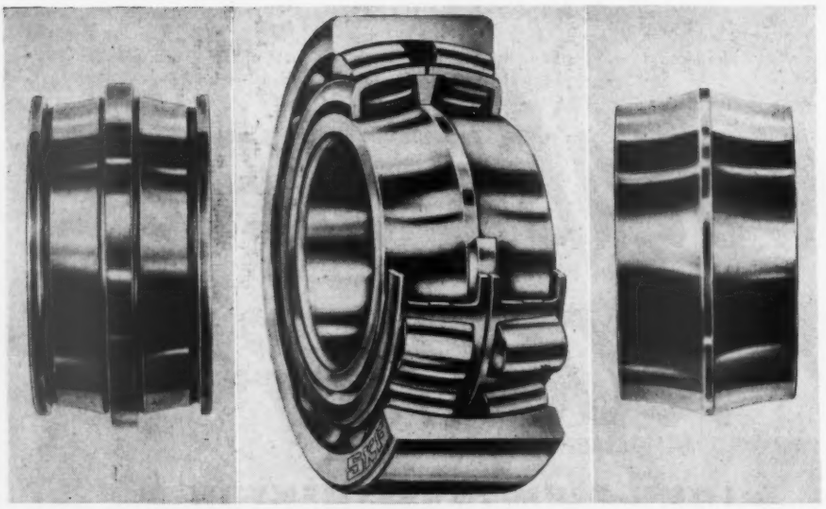
GREAT LAKES STEEL CORPORATION

PRODUCER OF N-A-X HIGH-TENSILE STEEL

STEEL FLOOR DIVISION — Ecorse, Detroit 29, Michigan

NATIONAL STEEL CORPORATION

SALES REPRESENTATIVES IN CHICAGO, PHILADELPHIA, ST. LOUIS, ATLANTA, OMAHA, DENVER, SAN FRANCISCO, MONTREAL AND NEW YORK.



Changes in the SKF roller-bearing design. Left, the conventional spherical roller-bearing inner ring flanges and adjacent undercuts. Center, a section of the assembled Type C bearing. Right, the new design inner ring, without undercuts or flanges.

Improved Bearing Increases Both Capacity and Service Life

Increased anti-friction bearing capacity of from 25 to 50 per cent, and service life two to three and one-half times longer than formerly possible, is now obtained with SF's improved design of spherical roller bearings. This performance improvement has been accomplished without change in size or weight.

The inner race of the improved bearing is a new design without undercuts and integral flanges. Its capacity is increased because longer rollers are used, with more effective contact between rollers and rings, in the larger area provided by the new design. A separate guide ring, between the two rows of rollers, allows them to take the position which their contact with the rings dictates. Load distribution is uniform at all times and greatly increased capacity and life result.

Each row of rollers is held in a window-type cage made of high-tensile-strength, cold rolled brass. Each cage centers on two large areas, one directly on the inner ring —outside of the rollers—and the other on the O.D. of the guide ring.

The new bearing offers equipment designers an opportunity to effect economies as the desired life can be obtained, using bearings of the same size, but under more severe loading conditions, and getting steadier operation performance.

Where combined loads are present, the improved spherical bearing is said to be capable of carrying heavier combinations of radial and thrust loads, or pure thrust loads of greater magnitude.

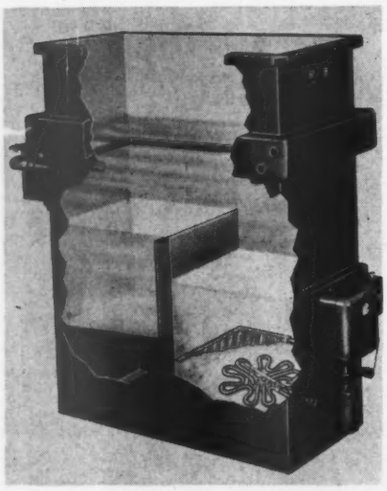
The rolling self-aligning feature, invented and developed by SKF, has been preserved, so that considerable misalignment between the shaft and housing has no ill effect on bearing capacity or life.

The improved spherical roller bearing, designated as the Type C, is available in

(*Continued on page 126*)

Series 222 and 223. A booklet giving specific sizes available, added capacity size-by-size, increased life for each size, dimensional tabulations, and load and speed data, may be obtained from SKF Industries, Inc., Dept. 616A, Philadelphia, 32, Pa.

■



Vapor Degreaser

A compact combination vapor degreasing unit is being produced by Phillips Manufacturing Company, 3471 West Touhy avenue, Chicago 45. The new unit is capable of performing 200 lb. of work per hour either in baskets or as individual pieces.

The new unit, the No. 100CS, incorporates cool rinses, hot rinse and vapor degreasing because it has both a rinse and boiling sump along with a water jacketed vapor area. Distilled solvent is collected by means of a condensate return trough, passed through a water separator and returned to the rinse sump. The boiling sump is fed by overflow from the rinse sump.

Heating is electrical and the unit is available for use with 110 or 120 volts d.c. and for 3-phase a.c. at 220, 440 and 550 volts.

The unit is 38 in. long, 18 in. wide, and 42 in. high. It is constructed of 14 gage steel structurally reinforced and arc welded, and hot dip galvanized.

A 3,000-watt cloverleaf type calrod unit provides the heating. This heater is located in the floor of the sump and replacement is simple. A flusher spray pump is available as optional equipment. As a solvent recovering still, the unit has a distillation rate of seven gal. per hr. based on 30 per cent contamination of solvent.

■

Hardfacing Welding Flux

A technique for automatic hardfacing has been developed in which the alloy content of the deposited metal is supplied by an agglomerated granular flux rather than by the electrode. It is now possible to apply automatic hardfacing with conventional mild steel electrodes. By diluting the hardfacing flux with mild steel flux, hardfacing properties can be matched exactly to service requirements.

Two fluxes have been developed and marketed by The Lincoln Electric Company, Cleveland 17, Flux H-545 is used whenever a smooth layer of abrasion resistance and high impact strength is required. This weld metal is an alloy of carbon, manganese, silicon, chromium, molybdenum and vanadium.

Flux H-550 is recommended for abrasion resistant deposits with good impact strength. It is an alloy of carbon, manganese, silicon, chromium and molybdenum. The deposit is magnetic, semiaustenitic at room temperatures.

Fire Retardant Paint

Recently developed by Fyr-Kote Co., Division of Morris Paint & Varnish Company, Omaha 2, Neb., is a fire retardant paint carrying the Underwriters Laboratories label classification.

When exposed to flame, this formulation designated Fyr-Kote pours out carbon dioxide and sodium chloride which smothers fire and retards the flame on the surface. It is said to be a washable flat wall paint, withstanding more than 25 cycles of scrubbing with strong washing powder and boiling water. The paint can be applied by either brush or spray.

AIRCO HELMETS: A complete line of helmets and face shields in a wide variety of styles and types. In any kind of service, these Airco products provide the greatest possible operator safety and comfort.

AIRCO HOLDERS: Famous Jackson jaw-type and Martin Wells screw-type holders. Nineteen Jackson models, from 200 to 500 amperes. Six Martin Wells, including the Heavy Duty Model 6S — the only holder on the market that will handle 700 amperes!

AIRCO GLOVES: The same quality that makes other Airco accessories the best value you can buy extends to welders' gloves and leather sleeves.

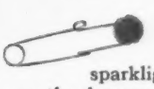
AIRCO CABLE AND CONNECTIONS: Unrivalled dependability, long life and flexibility. Sizes from 4 to 4/0, for wide range of amperages at varying distances from welding machine. Make sure of good connections with Airco ground clamps, cable splicers, Quik-Trik cable connectors and cable lugs.

RELY on AIRCO quality in both fields

... And soapstones, tip cleaners, clamps, circle cutting attachments, carrying cases, carbon pencils, carbon torches, graphite electrodes, chipping hammers, brushes . . . you name it — Airco has it at low prices. Call your Airco dealer or write us directly for your copy of Catalog 13, "Airco Welding Accessories," and complete price list.

AIRCO GOGGLES: for gas welding or cutting. Precision made, they afford excellent ventilation with maximum eye protection. All types exceed National Bureau of Standards requirements.

AIRCO CYLINDER TRUCKS: Make your welding and cutting outfit easily portable with an Airco two-wheel hand truck. Strong, rigid, welded steel frame; broad steel platform. Five models offer wheel sizes and styles for every type of surface.



AIRCO SPARKLIGHTERS: Save time and trouble with the standard Airco sparklighter and its replaceable round file, or the heavy-duty Airco Tri-Flint model, which carries three flints in a rotating holder.

AIRCO TWIN-HOSE: Two lines of hose moulded into a single, light, flexible unit. Close, tight braid permits thicker rubber cover for greater wear resistance.

AIRCO®

OFFICES IN MOST PRINCIPAL CITIES

AIR REDUCTION

60 East 42nd Street • New York 17, N. Y.

Air Reduction Sales Co. • Air Reduction Magnolia Co. • Air Reduction Pacific Co.
Represented Internationally by Airco Company International

Divisions of Air Reduction Company, Incorporated

at the frontiers of progress you'll find

AN AIR REDUCTION PRODUCT

NEWS

A.S.M.E. Annual Meeting

Sessions of the 1953 annual meeting of the American Society of Mechanical Engineers will be held in three New York hotels —the Statler, McAlpin, and Governor Clinton—November 29 to December 4, inclusive. Up to press time, no definite hotel assignments had been made for the various sessions. The tentative program, in part, follows:

MONDAY, NOVEMBER 30

9:30 a.m.

Fuels (I)

Fuel Trends in the Next Twenty Years.

2:30 p.m.

Fuels (II)

Storage Changes as They Influence the Oil Picture.

8:00 p.m.

Metals Engineering (II)—Applied Mechanics.

(III-B)

Thermal Checking of Wrought-Steel Railway Wheel Material, by H. R. Wetenkamp, University of Illinois.

TUESDAY, DECEMBER 1

9:30 a.m.

Gas-Turbine Power (III)—Fuels (IV)

A panel discussion covering residual fuels in the gas-turbine industry.

Oil and Gas Power (II)

Panel on Filtration of Fuel Oil.

2:30 p.m.

Railroad (I)—Oil and Gas Power (III)

Hydraulic Transmissions for Locomotives, by J. S. Newton, Baldwin-Lima-Hamilton Corp.

Standardization of Diesel Locomotives, by C. K. Steins, mechanical engineer, Pennsylvania.

WEDNESDAY, DECEMBER 2

9:30 a.m.

Railroad (II)—Lubrication (I)

Annual Report of Engineering Progress, by T. F. Perkinson, General Electric Co.

Symposium on the Technical Aspects of the Hot-Box Problem

The Hogan Antiwaste Roll Cavity and Ledge Journal Box, by B. R. Jones, assistant general mechanical superintendent, New York, New Haven & Hartford.

Packing Retainer for Railroad-Car Journal Boxes, by H. J. Stewart, Union Spring & Manufacturing Co.

Spring-Type Packing Retainer for Journal Boxes (15-min. color sound movie), by M. F. Brunner, Spring Packing Corp.

A New Mechanical Oiler for Car Journals, by V. E. McCoy, chief purchasing officer, Chicago, Milwaukee, St. Paul & Pacific.

Modernizing Journal Lubrication, by Karl Klinger, Roth Rubber Co.

The Plypak Waste Container and Retainer, by J. W. Hulson, vice-president, sales, Waugh Equipment Co.

Measurement of Stresses Imposed on Wheels in Locomotive Service, by L. L. Olson, Association of American Railroads.

Wheel Performance with Disk Brakes, by P. V. Garin, engineer tests, Southern Pacific.

Wheel Defects in Equipment with Clasp Brakes, by M. S. Riegel, supervisor personnel, New York Central System.

Railroading Today Through the Eyes of the Wheel Manufacturer, by C. B. Bryant, chief engineer, Technical Board, Wrought Steel Wheel Industry.

2:30 p.m.

Railroad (V)—Metal Processing
(V-A)—ASTM (II)

Pressure-Pouring Steel Car Wheels in Permanent Molds, by E. O. Sylvester, Griffin Wheel Co.

1.5 Per Cent Carbon Cast-Steel Railroad-Car Wheels, by N. A. Matthews, and R. A. Flinn, American Brake Shoe Co.

The Use of Steel Wheels in Freight Service, by B. C. Gunnell, chief mechanical engineer, Southern.

2:30 p.m.

Railroad (III)—Lubrication (II)

Symposium on Hot-Box Problems (Continued)

Effect of Viscosity on Car Journal Oils on the Running Temperature and Other Characteristics of Journal-Bearing Performance, by W. M. Keller, director mechanical research, Mechanical Division, A.A.R.

Hot Boxes—Some Fundamental Problems, by J. W. Hawthorne, general superintendent motive power and equipment, Atlantic Coast Line.

Effects of Off-Center Brake-Rod Pull on the Performance of Railroad Freight-Car Trucks, by H. T. Rockwell, New York Central System.

Hot Boxes and Train Operation, by G. R. Anderson, assistant chief mechanical officer, Chicago & North Western.

7:00 p.m.

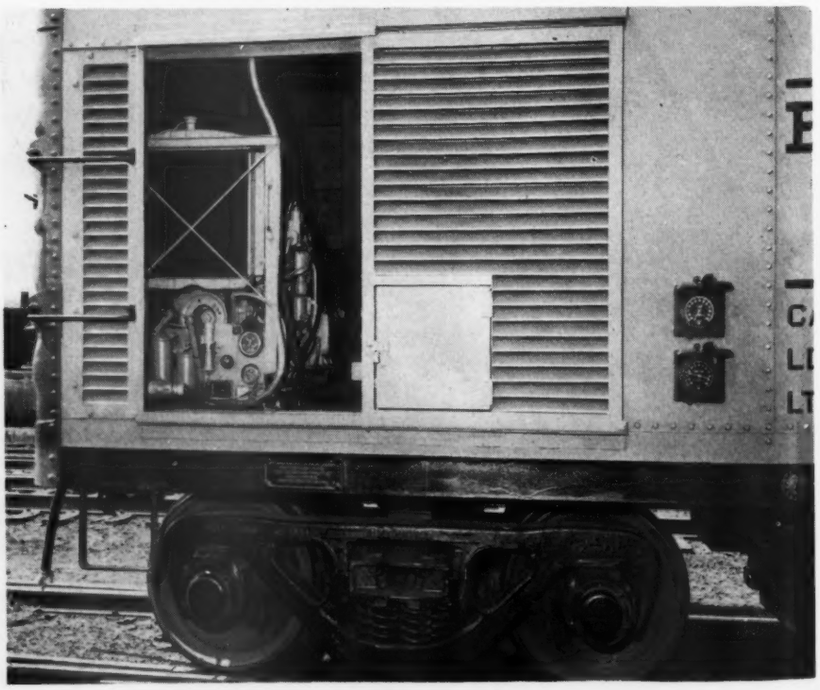
Banquet

THURSDAY, DECEMBER 3

Railroad (IV)—ASTM (I)

Symposium on Railway Steel Wheels

Wrought-Steel Passenger-Car Wheels from a Consumer's Standpoint, by A. M. Johnsen, Pullman Co.



The first of 30 new Chicago, Burlington & Quincy 70-ton "superinsulated" mechanical refrigerator cars, built at the Alexandria, Va., shops of the Fruit Growers Express Company. The cars are 50 ft. long—10 ft. more than conventional refrigerator cars—and the cubic capacity is 30 to 50 per cent greater. Mechanical-cooling equipment on this BREX refrigerator is of the Frigidaire-8 type, driven by a G. M. Detroit diesel engine. The cars also have automatic temperature control in heating and, hence, are all-purpose units, adapted to shipment of frozen foods as well as other perishables requiring milder cooling or warming up to 70 deg. F.

The cars are equipped with herring-bone floor racks, long-travel easy-riding truck springs, rubber-cushioned draft gear and roller bearings. Plug-in ceiling illumination will facilitate loading and unloading under all lighting conditions.

Grossman Receives "Recess Appointment"

CHARLES H. GROSSMAN, whose nomination as director of the I.C.C.'s Bureau of Locomotive Inspection as announced in the September issue, page 115, is now serving under a "recess appointment" until January, at which time Congress is slated to act on his permanent nomination.

Mr. Grossman was born on February 3, 1891, in Cleveland. He began his career on the Lake Shore & Michigan Central (now the New York Central) at the Collinwood shop in September 1907. He later served, as a fireman in road service and locomotive engineer until his appointment on April 4, 1918, as an inspector of locomotives for the Bureau of Locomotive Inspection, with headquarters at Cleveland. He was transferred to Toledo in 1918 and to the southwest district, with headquarters at Albuquerque, N. M., on April 1, 1919. He was appointed director of the Bureau by the president on September 4 of this year and took the oath of office on September 11.

C. H. Grossman

SUMMARY OF MONTHLY HOT BOX REPORTS

	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes			Miles per hot box car set off between division terminals
		System	Foreign	Total	
July, 1950	2,745,932,894	.....	.....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,599
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057
July, 1951	2,768,920,095	8,886	18,823	27,709	99,929
August, 1951	3,009,371,111	9,023	19,092	28,115	107,038
September, 1951	2,925,570,545	6,472	13,565	20,037	146,008
October, 1951	3,116,490,095	4,131	9,053	13,184	236,384
November, 1951	2,939,503,144	2,022	4,405	6,427	457,368
December, 1951	2,752,316,133	2,130	5,398	7,528	365,611
January, 1952	2,824,298,630	3,208	7,197	10,405	271,437
February, 1952	2,809,162,671	2,723	6,473	9,196	305,477
March, 1952	2,943,812,727	2,594	5,877	8,471	347,517
April, 1952	2,766,313,714	3,826	7,759	11,585	238,784
May, 1952	2,918,508,445	6,020	10,938	16,958	172,102
June, 1952	2,672,512,889	8,466	14,495	22,961	116,394
July, 1952	2,575,298,912	10,566	15,833	26,399	97,553
August, 1952	2,924,917,122	11,658	17,535	29,193	100,192
September, 1952	2,931,129,734	7,536	13,608	21,144	138,627
October, 1952	3,093,990,289	4,058	8,053	12,111	255,469
November, 1952	2,984,101,808	2,198	4,501	6,699	445,455
December, 1952	2,869,928,617	1,742	3,632	5,374	534,040
January, 1953	2,828,906,282	2,219	4,123	6,342	446,059
February, 1953	2,625,563,462	2,111	4,059	6,170	425,537
March, 1953	2,904,227,804	2,696	6,077	8,769	331,192
April, 1953	2,850,752,648	3,383	6,435	9,818	290,359
May, 1952	3,013,610,843	5,892	11,433	17,325	173,945
June, 1952	2,672,512,889	8,466	14,495	23,833	116,394
July, 1952	2,925,317,024	9,342	15,775	25,117	116,467

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE OCTOBER ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of units	Horsepower	Service	Builder
Georgia	2[1]	1,500	Genral purpose	Electro-Motive
Northern Pacific	10[2]	1,500	Road switch	Electro-Motive
	8[2]	1,500	Road freight	Electro-Motive
	3[2]	1,500	Passenger	Electro-Motive
	4[2]	1,600	Road switch	Alco-G. E.
	5[3]	1,000	Switch	Alco-G. E.

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Baltimore & Ohio	12[3]	Caboose	Company shops
Chicago, Indianapolis & Louisville	150[4]	50-ton hopper	Pullman-Standard
	30[4]	Covered hopper	Pullman-Standard
Continental Blacks, In.	15[5]	Covered hopper	Thrall Car Mfg.
Illinois Central	100[6]	70-ton covered hopper	American Car & Fdry.
New York, New Haven & Hartford	100[7]	Flat	Company shops
New York Central	25[8]	50-ton box	Pullman-Standard
Southern Pacific	1,250	Box	Company shops
Transportation Corps	320	50-ton box	Pullman-Standard
Western Pacific	10[9]	50-ton box	Pullman-Standard

FREIGHT-CAR INQUIRIES

New York, New Haven & Hartford	500–1,000	70-ton gondola

PASSENGER-CAR ORDERS

Road	No. of cars	Type of car	Builder
Canadian Pacific	4[10]	Rail diesel	Budd Co.

[1] For delivery this month.
[2] Switchers and road switchers to be delivered in December; the road locomotives, during February and March.
[3] Estimated cost, $7,000 each. Delivery to be completed by January 1.
[4] Estimated cost,$870,000. Delivery of 50-ton hopper cars expected during first half of 1954. Covered hopper cars to be equipped with an air unloading system. Delivery expected this month.
[5] Delivery scheduled for first quarter of 1954.
[6] To have round hatches.
[7] For use in trailer-on-flat-car service.
[8] Cost, $190,000. Delivery schedule for first quarter of 1954.
[9] To have cushion underframes. Cost, $75,000.
[10] Three cars to have a seating capacity for 89 passengers. The fourth car to be divided into a baggage, express and mail compartment.

NOTE: *St. Louis-San Francisco.*—The Frisco's board of directors has authorized acquisition of five 1,500-hp. "B" road freight units at a cost of $762,408.

SUPPLY TRADE NOTES

GENERAL AMERICAN TRANSPORTATION CORPORATION.—General American has opened a southern California sales office at 900 Wilshire boulevard, Los Angeles, with *Ben King Duffy* as district sales manager. Mr. Duffy was formerly plate and welding division sales manager at Pittsburgh. A field erection shop is also being constructed at Colton, Cal., to facilitate erection of Wiggins floating roofs and Wiggins conservation structures. *E. D. Rollins*, western sales manager, at San Francisco, will supervise the entire west coast operation.

■

RALPH J. FROST, sales engineer at Chicago for Thomas A. Edison, Inc., Primary Battery division, has retired.

■

AMERICAN BRAKE SHOE COMPANY, BRAKE SHOE & CASTINGS DIVISION.—*S. Whitney Dickey* has been appointed district sales manager. Mr. Dickey, who was formerly a sales representative for the Division, will be located in New York.

■

CLARK EQUIPMENT COMPANY.—The southeastern regional sales office has been moved from Norfolk, Va., to 161 Spring Street building, Atlanta, Ga.

■

MINNESOTA MINING & MANUFACTURING CO.; GUSTIN-BACON MANUFACTURING COMPANY.—Minnesota Mining and Gustin-Bacon have announced an agreement

whereby the former company acquires certain Gustin-Bacon patents and inventions relating to the manufacture of glass-fiber-reinforced plastic pipe. The two companies also agree to co-operate in research and development work concerned with perfecting and improving the glass-plastic pipe together with a line of fittings and couplings.

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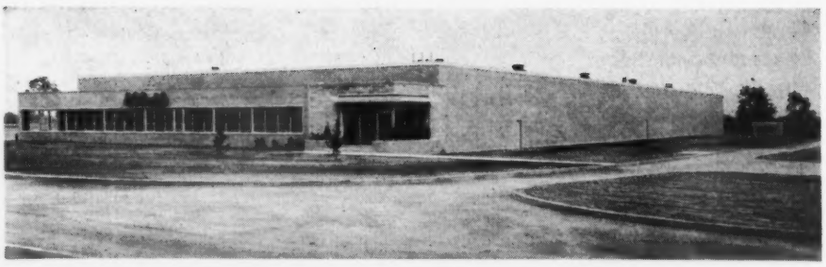


Million-dollar A. O. Smith plant for production of coated welding electrodes recently completed by the A. O. Smith Corporation near Lancaster, Pa.

A. O. SMITH CORPORATION.— *The U.S. Steel division of U.S. Steel Corporation* has been appointed distributor for A. O. Smith welding products in the West Coast area, with warehouse facilities in Los Angeles, San Francisco and Portland, Ore.

A plant for the manufacture of welding electrodes was recently opened near Lancaster, Pa. The plant with 41,000 sq. ft. of floor surface, has a single production line which operates at the rate of 20 electrodes per second, coated by the extrusion process. The plant is designed for complete control of interior atmospheric conditions and uniform lighting. The building has neither windows nor skylights. Incoming air is filtered and propane gas is used both for the baking ovens and heating the building. In addition to the control of process conditions and sampling and testing of raw materials, a system of statistical control is employed by which variations from normal tolerances in the quality of materials and concentricity of coatings, are quickly detected.

The building has a space for two additional production lines.

■

ELECTRIC STORAGE BATTERY COMPANY.— Supplementing his duties as vice-president and director *Roland Whitehurst* has been appointed general manager of the industrial products division. The company's operations have been separated into two divisions, industrial products and automotive products.

■

AMERICAN LOCOMOTIVE COMPANY.— *American Locomotive Company* will build a warehouse and office building at Bingham avenue and Ray street, St. Louis, which is expected to be completed late next spring. The one-story structure, with 30,000 sq. ft. of floor space, will serve as Alco's diesel locomotive parts storage depot in the Southwest, with space available for the district sales staff.

■

UNION CARBIDE & CARBON CORP.—*Dr. Raymond W. McNamee* has been appointed manager of research administration.

CARBIDE & CARBON CHEMICALS CO.—*Dr. Franklin Johnston* has been appointed superintendent of the Research and Development Department to succeed Dr. McNamee.

BAKELITE COMPANY.—*Dr. James F. Eversole*, manager of research administration of Union Carbide & Carbon, has been appointed vice-president in charge of research of the Bakelite Company division of Union Carbide.

OXWELD RAILROAD SERVICE COMPANY.— *James W. Lacey*, service engineer, has been appointed district manager at Chicago, succeeding *William A. Hogan*, retired.

■

QUAKER RUBBER CORPORATION—DIVISION H. K. PORTER COMPANY—A new factory warehouse and sales office of Quaker Rubber has been opened at 4384 E. Bandini boulevard, Los Angeles, under supervision of *James Joyner*.

■

PYRENE MANUFACTURING COMPANY.— Pyrene has made a non-exclusive arrangement with *Grinnell Company* for sale and installation of Pyrene fire extinguishing systems, which also will continue to be sold through Pyrene's own district offices and air foam jobbers, as before.

(Continued on page 140)

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of June		6 months ended with June	
		1953	1952	1953	1952
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	12,490	14,705	74,941	107,147
3-06	Total, Diesel-electric	31,585	26,450	183,943	158,873
3-07	Total, electric	721	697	4,437	4,654
3-04	Total, locomotive-miles	44,856	41,891	263,682	270,779
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,685	1,502	9,945	9,763
4-06	Empty, total	927	860	5,404	5,360
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	22,391	24,529	133,738	191,068
6-02	Total in oil-burning steam locomotive trains	6,971	8,161	35,701	49,094
6-03	Total in Diesel-electric locomotive trains	88,784	71,527	515,197	439,337
6-04	Total in electric locomotive trains	2,069	1,925	12,592	12,967
6-06	Total in all trains	120,393	106,286	698,471	692,912
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.03	1.03	1.03	1.04
10-02	Loaded freight car-miles	40.80	39.00	40.90	39.50
10-03	Empty freight car-miles	22.50	22.40	22.20	21.70
10-04	Total freight car-miles (excluding caboose)	63.30	61.40	63.10	61.20
10-05	Gross ton-miles (excluding locomotive and tender)	2,917	2,763	2,873	2,806
10-06	Net ton-miles	1,337	1,230	1,303	1,291
12	Net ton-miles per loaded car-mile (M-211)	32.80	31.50	31.80	32.70
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	64.50	63.60	64.80	64.60
14	Averages per train hour (M-211):				
14-01	Train miles	17.90	17.90	18.20	17.60
14-02	Gross ton-miles (excluding locomotive and tender)	51,508	48.817	51.857	48.807
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	46.80	42.60	45.60	44.80
14-02	All	44.60	40.40	43.50	42.60
15	Average net ton-miles per freight car-day (M-240)	942	810	897	898
17	Per cent of home cars of total freight cars on the line (M-240)	45.30	47.70	46.80	43.60

PASSENGER SERVICE (DATA FROM I. C. C. M-213)

3	Road motive-power miles (000):				
3-05	Steam	4,155	6,391	27,407	44,034
3-06	Diesel-electric	19,848	18,690	118,924	109,145
3-07	Electric	1,481	1,581	9,278	9,803
3-04	Total	25,484	26,662	155,610	162,989
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	258,659	268,179	1,565,401	1,618,925
4-09	Total in coal-burning steam locomotive trains	23,196	31,407	157,600	229,702
4-10	Total in oil-burning steam locomotive trains	15,415	25,657	88,198	154,546
4-11	Total in Diesel-electric locomotive trains	203,881	193,763	1,215,972	1,125,772
12	Total car-miles per train-miles	9.82	9.83	9.75	9.74

YARD SERVICE (DATA FROM I.C.C. M-215)

1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	593	621	3,608	5,166
1-02	Steam, oil-burning	114	161	674	1,007
1-03	Diesel-electric	3,450	2,840	20,381	18,660
1-06	Total	4,175	3,644	24,789	24,973
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	20	24	128	182
2-02	Steam, oil-burning	7	10	40	68
2-03	Diesel-electric	250	251	1,533	1,531
2-06	Total	308	317	1,893	1,981
3	Hours per yard locomotive-day:				
3-01	Steam	7.10	5.80	6.60	7.10
3-02	Diesel-electric[1]	16.40	14.80	16.30	16.40
3-05	Serviceable	15.20	13.10	14.80	14.30
3-06	All locomotives (serviceable, unserviceable and stored)	13.40	11.20	13.00	12.40
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.72	1.69	1.72	1.77
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.74	0.73	0.75	0.76

[1]Excludes B and trailing A units.

Centrifugal Lining
by Bearing Experts

. . . that's one reason why you get

MAXIMUM *TROUBLE-FREE* MILEAGE

with **MAGNUS TRACTION MOTOR SUPPORT BEARINGS**


Top half


Window half

THESE High Mileage bearings are precision lined with heat-resistant Satco metal, centrifugally applied. This assures uniform hardening and density and a permanent bond—a lining that stands up longer under high temperatures, gives maximum resistance to wear and load.

There are other important advantages, too. Interchangeable double keeway permits any bearing to be used on either the commutator or pinion end of the shaft. Perfectly mated bearing halves are micrometer tested under load, assuring paralleled ID and OD. And the hi-strength brass backs are finish bored on special precision machines.

These features combine to give you a bearing you can depend on for maximum trouble-free performance between motor overhauls. For complete information, send for your copy of Bulletin No. 6000. Magnus Metal Corporation, 111 Broadway, New York 6, N. Y.; or 80 East Jackson Blvd., Chicago 4, Ill.

IT PAYS TO PLAY SAFE!

Use only NEW Magnus Bearings for replacement purposes

New High-Mileage Magnus bearings cost so little because of skilled production methods they can usually be furnished for less than the cost of rebuilding worn bearings. And only new Magnus bearings give full protection to your big investment in Diesel locomotives.

MAGNUS
High Mileage
TRACTION MOTOR SUPPORT BEARINGS
. . . for every type and make of diesel locomotive

MAGNUS METAL CORPORATION *Subsidiary of* **NATIONAL LEAD COMPANY**

NATIONAL MALLEABLE & STEEL CASTINGS COMPANY.—*Roy C. Hobson*, assistant to vice-president, sales, at Cleveland, has been appointed assistant manager of the Chicago works. *Mark M. Miller*, sales manager at Indianapolis, has assumed Mr. Hobson's duties in Cleveland, and has been succeededed by *John H. Murphy*. *John A. Koehl* has been named to assistant sales manager at Indianapolis.

R. C. Hobson

M. M. Miller

J. H. Murphy

The new million-dollar Technical Center of National Malleable, located adjacent to its Cleveland plant, was formally introduced to representatives of industrial publications, railways and industry during the week of October 12. A description of the center will appear later.

BONNEY FORGE & TOOL WORKS.—*Roger O. Bay* has been elected a vice-president at Allentown, Pa. Mr. Bay will continue to serve as sales manager of Bonney's Tool Division, a position to which he was appointed in May of this year. Prior to that he was sales manager of the Automotive Division, Cleveland Pneumatic Tool Company.

■

GENERAL STEEL CASTINGS CORPORATION.—*Michael J. Donovan*, vice-president of the Franklin Railway Supply Company,

M. J. Donovan

has been appointed assistant vice-president—engineering of the General Steel Castings Corporation at Granite City, Ill.

■

STANDARD CAR TRUCK COMPANY.—*Charles P. Leese*, assistant vice-president and chief engineer, has been appointed vice-president in charge of engineering, and *Ray C. Williams* has been appointed

C. P. Leese

engineering assistant to the president. Mr. Williams was previously administrative engineer of the Road and Track Equipment Division of the Pullman-Standard Car Manufacturing Company.

■

MID-WEST FORGING & MANUFACTURING COMPANY.—*Milton W. Allen & Son*, Denver, has been appointed representative in the Denver-Salt Lake City territory for Mid-West Forging.

WESTINGHOUSE AIR BRAKE COMPANY.—*G. W. Misner* has been appointed executive assistant to *S. L. Poorman*, vice-president of sales. Mr. Misner has been head of the

H. W. P. Wiss

commercial engineering section at Wilmerding, Pa., since 1943, and will continue to supervise that department. *H. W. P. Wiss*,

C. J. Sekera

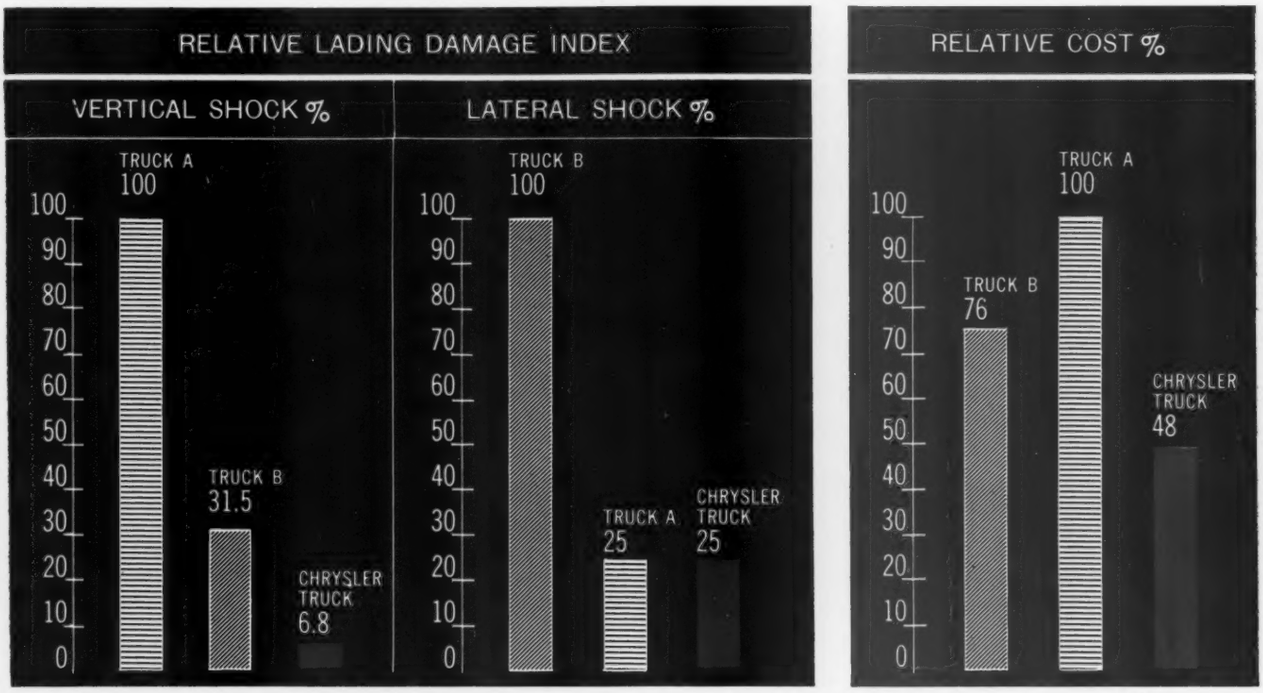
a representative in the western district, with office in Denver, has been promoted to assistant manager of that district, at

I. D. Ross

Chicago. *C. J. Sekera*, mechanical expert, and *I. D. Ross*, service engineer, have been appointed representatives, with headquarters, respectively, in Denver and Chicago.

Impartial railroad tests of trucks for high-speed BX service prove

you can "deliver the goods" at less cost to you with Chrysler Design Railroad Freight Trucks



▲ *Comparative vertical and lateral lading damage index and cost of Chrysler Design versus two other leading "BX Type" trucks. Shock measurements taken from impartial high-speed road tests.*

HERE are the results of a series of *completely impartial* tests conducted by one of the largest railroads, over its own lines, to determine the comparative performance of the leading high-speed freight car trucks.

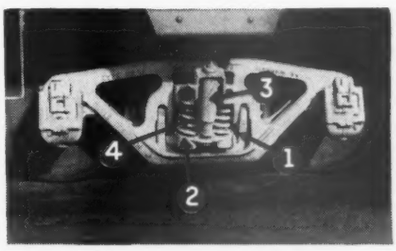
In these tests Chrysler Design Trucks—built on a completely new application of the fundamental principles of Balanced Suspension—demonstrated great superiority over other high-speed trucks in protecting car and lading from vertical and lateral shocks.

Obviously, this proved performance means fewer damage claims and more satisfied shippers. But does it cost a premium in price? Just the opposite! Chrysler Design Trucks are the lowest in price of all the trucks designated as "BX Type" in these comparative tests.

In fact, their cost is so low that it represents only a modest premium over conventional freight trucks which are not designed for the continuous high speeds in head-end passenger service. This will be repaid many times over in the regular freight movement of fragile merchandise, through reduced damage claims and the intangible but most important factor of shipper satisfaction.

Is it any wonder that users report exceptionally high earnings for cars equipped with Chrysler Design Trucks?

If you'd like to know more about Chrysler Design Freight Trucks, write Chrysler Corporation, Engineering Division, P. O. Box 1118, Detroit 31, Michigan.



THIS IS BALANCED SUSPENSION

(1) Rigid U-shaped swing hangers provide high-capacity, shock-absorbing lateral motion. Combined stiffness of swing hangers and (2) special cast steel spring plank maintains positive alignment of side frames—without requiring high pressure and resultant wear between bolster and side frame columns. (3) Chrysler Design self-contained, long-wearing, constant friction snubbers work with (4) the longest travel AAR standard coil springs to absorb vertical shocks and control spring oscillation.

A result of Chrysler Corporation's continuous research into every phase of vehicle design and suspension, Chrysler Design Railroad Freight Trucks are manufactured and sold by the Symington-Gould Corporation, Depew, N. Y., under Chrysler license. Chrysler Design railroad friction snubbers are manufactured and sold under Chrysler license by the Houdaille-Hershey Corporation, Detroit 2, Michigan.

CHRYSLER CORPORATION

You will enjoy Medallion Theatre—dramatic entertainment for the whole family on CBS-TV

PLYMOUTH • DODGE • DE SOTO • CHRYSLER & IMPERIAL

WESTINGHOUSE AIR BRAKE COMPANY.—"At This Moment," a new Westinghouse colored railroad film, was shown for the first time on September 25 at a luncheon at the Hotel William Penn, Pittsburgh, where the board of directors of the Association of American Railroads were the guests of honor. The picture aims to portray the position of the railroad industry in the national economy—its importance to the maintenance of living standards and to the national defense—and also to show some of the great improvements the railroads are making to keep their service thoroughly modern. The film is designed for general public showing, and is entertaining and informative. It is non-controversial; and is non-commercial, in that no specific products or services are promoted. The Westinghouse Company made the film, as President Edward O. Boshell explained, as a contribution toward better public understanding of the importance of the railroad industry to the national welfare. The film was produced for Westinghouse by the Jam Handy Organization, Inc., of Detroit.

■

GRAYBAR ELECTRIC COMPANY.—A new branch has been opened at Springfield, Ill. *Harry Bryson* was appointed manager of the new branch, and *C. W. Kraich* is operating manager.

■

TIMKEN ROLLER BEARING COMPANY.—*George W. Curtis*, Milwaukee division sales manager has retired. Responsibility for the Milwaukee Industrial Sales Division has been divided among the district offices in that city, Minneapolis and Moline.

Obituary

HORACE G. SWAN, engineer of tests of the Symington-Gould Corporation, died at his home in East Aurora, N.Y., on September 7.

■

HERBERT D. TIETZ, 55, manager of sales of the Inco nickel alloys department of International Nickel Company, at New York, died October 11.

■

ROY F. JOHNSON, manager, sales and service engineering division, Pullman-Standard Car Manufacturing Company,

R. F. Johnson

died September 6 of a heart attack while sailing on Lake Michigan near Michigan City, Ind.

PERSONAL MENTION

Atchison, Topeka & Santa Fe

H. F. MACKEY, division master mechanic at Chicago, appointed mechanical superintendent of eastern mechanical district at Shopton, Iowa.

J. W. ATKINSON, mechanical superintendent of eastern mechanical district at Shopton, Iowa, has retired.

Canadian National

A. D. MCPHEE, car foreman at Campbellton, N.B., appointed car foreman at Moncton, N.B.

F. T. LAHEY, car foreman at South Devon, N.B., appointed car foreman at Campbellton, N.B.

L. F. BROWN, car foreman at New Carlisle, Que., appointed car foreman at South Devon, N.B.

L. A. GANTHAM, car foreman at Halifax, N.S., has retired.

J. M. KIRBY, car foreman, coach yard, at Moncton, N.B., appointed car foreman at Halifax, N.S.

Canadian Pacific

R. M. MOCHRIE, assistant superintendent of car equipment at Winnipeg, Man., has retired.

FRED WOOLLEY, general car foreman at Moose Jaw, Sask., appointed assistant superintendent of car equipment at Winnipeg, Man.

THOS. FARMER appointed general car foreman at Moose Jaw, Sask.

LEONARD WOOLLEY, freight shop foreman, Ogden shops, at Calgary, Alta., appointed car foreman at Regina, Sask.

H. G. HEWITT, coach shop foreman, Ogden shops, Calgary, Alta., appointed freight shop foreman.

J. L. K. ISON, pipe fitter foreman, Ogden shops, Calgary, Alta., appointed coach shop foreman.

Chesapeake & Ohio

S. M. EHRMAN, assistant supervisor work simplification, appointed general car foreman at Columbus, Ohio.

Chicago & Eastern Illinois

C. W. BILLINGS, mechanical engineer at Danville, Ill., has retired.

D. L. EAGEL, chief draftsman, appointed mechanical engineer at Danville, Ill.

Chicago, Milwaukee, St. Paul & Pacific

E. L. GROTE, district master mechanic at Minneapolis, has had jurisdiction extended to cover all car department matters on LaCrosse and River division, Second District, to, but not including, LaCrosse.

W. J. WEATHERALL, appointed assistant district general car foreman, with juris-

STATEMENT required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946 (Title 39, United States Code, Section 233) showing the ownership, management, and circulation of *Railway Locomotives and Cars*, published monthly at Philadelphia, Penna., for November, 1953.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Corporation. 30 Church Street, New York 7, N.Y.

Editor, C. B. Peck, 30 Church Street, New York 7, N.Y.

Managing editor, H. C. Wilcox, 30 Church Street, New York 7, N.Y.

Business manager, C. W. Merriken, Jr., 30 Church Street, New York 7, N.Y.

2. That the owners are: Simmons-Boardman Publishing Corp., 30 Church St., New York 7, N.Y.; stockholders of 1 per cent, William E. Russell as Executor of W. & T. of Ida R. Simmons Estate, 41 East 42nd St., New York 17, N.Y.; S. O. Dunn, 79 West Monroe St., Chicago 3, Ill.; James G. Lyne & Louise Lyne, 30 Church St., New York 7, N.Y.; Arthur J. McGinnis, 30 Church St., New York 7, N.Y.; Conrad J. Wageman & Florence F. Wageman, 79 West Monroe St., Chicago 3, Ill.; Mrs. Carrie E. Dunn, 221 East Chestnut St., Chicago 11, Ill.; Mrs. Mae E. Howson, 6922 Paxton Ave., Chicago, Ill.; Ella L. Mills & Catherine S. Mills, Westfield, N. J.; Mrs. Ruth W. Johnson, 1615 Ravenna Blvd., Seattle, Wash.; J. V. McManus, 39 Broadway, New York, N.Y.; J. Streicher & Co., 2 Rector St., New York, N.Y.; Partners of J. Streicher & Co. are Joseph Streicher, Jack L. Streicher, Ethel Streicher, Judson Streicher, all of 2 Rector St., New York, N.Y.; J. W. Gould & Co., 120 Broadway, New York N.Y.; Partners of J. W. Gould & Co. are Jerome W Gould, Arthur A. Gould, Joseph Reichwein, all of 120 Broadway, New York, N.Y.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

C. B. PECK,
Editor.

Sworn to and subscribed before me this twenty-eighth day of September, 1953.

EDMUND J. PUYDAK.
Notary Public, State of New York No. 41-3179300
Qualified in Queens County
Certs. filed with New York Co. Clk. & Reg.
[SEAL] (My commission expires March 30, 1955)

diction over all car department matters in the Northern District and including Marquette, Ia., but not the River Division of Twin City Terminal. Headquarters, Minneapolis.

D. A. RADABAUGH appointed assistant master mechanic, Rocky Mountain division, with headquarters at Deer Lodge, Mont.

Erie

DAVID H. DECKER appointed division car foreman, in charge of all freight car work to and including Suffern, N.Y. Headquarters, Jersey City, N.J.

TONY M. BOMERSBACK, division car foreman at Hammond, Ind., has retired.

CHESTER E. KNORR appointed division car foreman, with headquarters at Hammond, Ind.

Georgia & Florida

L. J. WATERS, acting superintendent motive power has been appointed superintendent motive power at Douglas, Ga., reporting to the superintendent.

Louisville & Nashville

J. B. QUIGGINS, assistant master mechanic at Boyles, Ala., appointed master mechanic, succeeding R. E. McWilliams, resigned.

RUFUS J. MAY, inspector of safety at Louisville, Ky., appointed assistant master mechanic at Boyles, Ala.

Northern Pacific

A. H. FIEDLER, superintendent of motive power, western district, at Seattle, Wash., has retired.

J. A. CANNON, formerly master mechanic of the Spokane, Portland & Seattle, at Vancouver, Wash., appointed superintendent of motive power of the NP at Seattle, Wash.

Seaboard Air Line

LYNWOOD B. ALEXANDER, shop superintendent at Jacksonville, Fla., appointed assistant chief mechanical officer at Norfolk, Va.

Career: Since 1926 in the mechanical department of the SAL at Tampa, Fla.;

Lynwood B. Alexander

Portsmouth, Va.; Raleigh, N. C.; Wildwood, Fla. Appointed assistant shop superintendent for locomotives at Jacksonville, Fla., in November 1947, and shop superintendent on August 1, 1949.

H. E. AENCHBACHER, assistant shop superintendent at Jacksonville, Fla., appointed shop superintendent at Jacksonville. Jurisdiction over mechanical department operations at Baldwin, Fla., transferred from master mechanic, North Florida division, to shop superintendent at Jacksonville.

Spokane, Portland & Seattle

C. E. BARNES, master mechanic at Vancouver, Wash., appointed general superintendent motive power.

L. Z. DANIELS, assistant master mechanic at Vancouver, Wash., appointed master mechanic.

Texas & Pacific

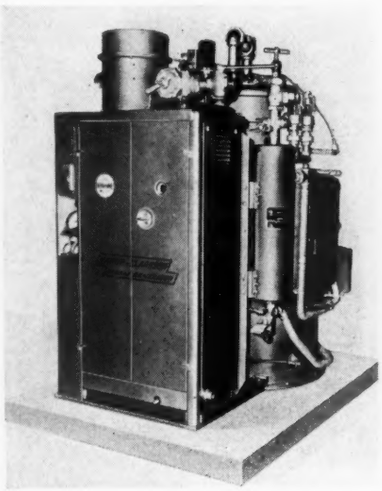
FORREST R. DENNEY, assistant mechanical superintendent at Dallas, Tex., appointed supervisor of equipment of the New Orleans, La., Union Passenger Terminal.

Education: Purdue University (B.S. in mechanical engineering 1924).

Career: Worked for the Cleveland, Cincinnati, Chicago & St. Louis and a railroad supply house before entering the mechanical department of the T&P at Fort Worth, Tex. Became assistant mechanical superintendent in July 1946 after serving in various supervisory positions at different points on the road.

New Devices

(Continued from page 126)



Dual-Fuel Steam Generator

Vapor Heating Corporation, Chicago, has developed a Vapor-Clarkson steam generator Model OKJ-4740 that can change from fuel-oil to natural gas fuel by flipping one switch and without interrupting steam output. Industries located in areas where natural gas fuel is available only part of the time will be particularly interested in this development.

The fuel-oil spray nozzle is incorporated into the metal body of the gas burner. When the fuel selection switch is changed from natural gas to oil, the motorized gas valve closes and the fuel-oil solenoid valve opens, releasing oil under pressure to the spray nozzle. Fuel oil is always ready to be released to the combustion chamber because it is continuously circulated through the steam generator's hydraulic modulating controls. A constant spark and pilot light insure positive lighting.

This Vapor-Clarkson steam generator, Model OKJ-4740, develops full working steam pressure up to 300-lb. pressure in less than three minutes from cold water, and makes 1,500 to 5,000 lb. of steam per hour. It is said to be over 80 per cent efficient.

Once started, by turning one switch, automatic controls take over causing the steam generator to turn on and off and modulate steam output to meet a changing steam demand. The steam pressure may be changed from 10 to 300 lb. pressure by turning one control.

There are several protective safety controls such as: The steam temperature limit control; low water shut off; two safety valves; overload relays; electric eye and others, built into the generators, which are made in accordance with ASME, Hartford and Underwriters specifications.

This Vapor-Clarkson steam generator is a complete package which includes the 7½-hp. electric motor, blower, feed water pump, steam separator, steel coils, and all the controls, in a trim cabinet. A fork lift truck can pick up this steam making ma-

(Continued on page 152)

SAFE · FAST · DEPENDABLE

Certified

NON SPIN

QUICK RELEASE

GRADUAL-RELEASE

MINER

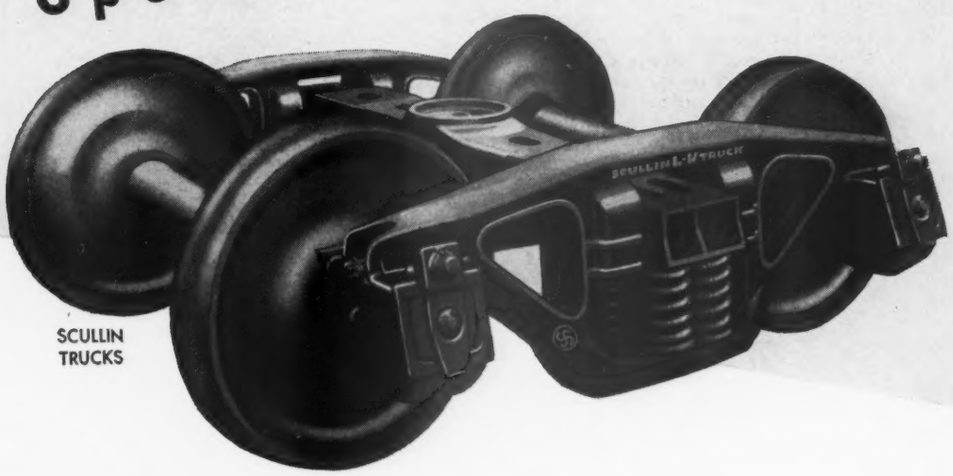
power hand brake

D-3290-XL

W. H. MINER, INC. CHICAGO

FREIGHT CAR MASTERPIECES

High Speed Trucks

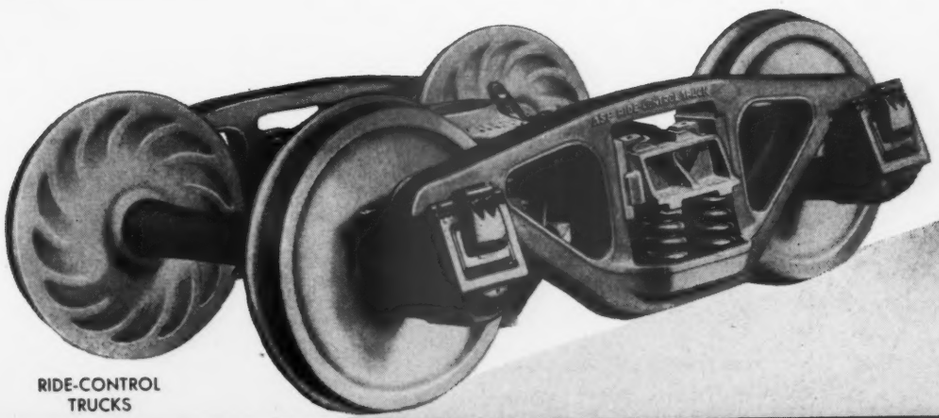


SCULLIN TRUCKS

BARBER STABILIZED TRUCKS

SCULLIN TRUCKS

Truck Side Frames and Truck Bolsters Produced by Scullin Steel Co.



RIDE-CONTROL TRUCKS

STEEL CASTINGS MANUFACTURER

NEW YORK
CHICAGO
BALTIMORE
RICHMOND, VA

SCULLIN STEEL CO.

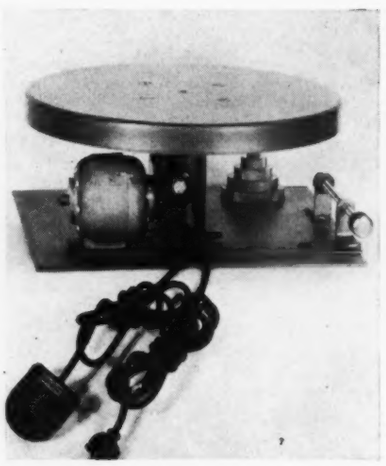
SAINT LOUIS 10 MISSOURI

(*Continued from page 149*)

chine which weighs about 6,000 lb. and is about one-fourth the size of a conventional type boiler.

By making electrical, steam, fuel, and water connections the unit is ready to be put into operation. The overall dimensions are—50 in. wide, 80 in. high, 73 in. long.

■



Variable Speed Work Positioner

Portable and electrically turned, this variable speed work positioner is offered both as a bench or pedestal model and with accessories to make it inclinable and operable intermittently.

Announced by All-State Welding Alloys Co., Inc., White Plains, N.Y., it is designated as the model Unique. The device is said to be applicable for holding work that requires welding, brazing, soldering, tinning, metalizing and assembly.

Without the pedestal, it weighs 31 lb., is 5-½ in. high and covers an area of 20 in. by 18 in. The turntable is 15-½ in. in dia. It is rated for a work load of 300 lb. and the table can revolve continuously or intermittently at speeds adjustable upward from ¼ r.p.m. The unit is powered from any 110 volt, 60 cycle electric power circuit.

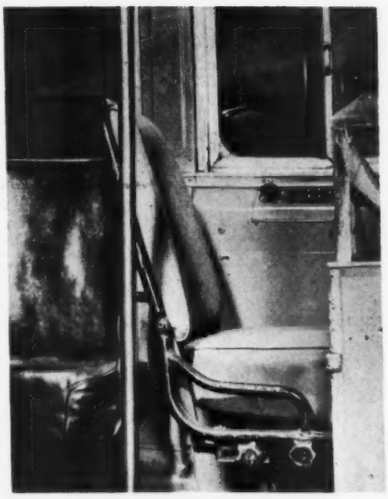
■

Weld Strength Calculator

A weld strength calculator has been made available for the convenience of designers and engineers interested in steel plate fabrication.

Made by Lukens Steel Company, Coatesville, Pa., the calculator is a pocket-sized plastic slide rule that indicates both the size of the weld required for a given applied load, and the weight of a given length of weld in pounds. The device gives values for stresses ranging from 2000 to 20,000 lb. per sq. in. and applied loads from 9000 to 450,000 lb.

Basic design data for welded connections, formulas for calculating nominal properties of welds are listed on the reverse side of the pocket-size calculator.



Foam Fabric Upholstery

A foam-fabric upholstery designed for use in passenger trains, long-distance trucks and other vehicles is now being marketed by the Andrews-Alderfer Company, Akron 10, Ohio.

Called Andal by its maker, the upholstery is formed by means of a process that embeds a gabardine-type fabric in ⅛ in. of foamed latex. The finished combination has breathing qualities as the porosity of neither component is sealed. The combination fabrics can be washed repeatedly without damage to the foam.

A wide variety of fabrics can be located with thin gauges of latex foam ranging from 1/32 to ¼ in. Foam densities are available to meet individual requirements.

■

Pressure Reducing Regulating Valves

This, the Type BBC valve, is intended for use on Bunker C and other grade oils as well as dirty liquids or fluids with a high viscosity. All sizes are of direct acting, single seated, spring loaded diaphragm type and can be utilized to reduce a high pressure to a lower pressure and maintain it at a constant.

Developed by the A. W. Cash Valve

(*Continued on page 156*)

New Devices

(*Continued from page 153*)

Manufacturing Corporation, Decatur, Ill., they have a maximum initial pressure in iron of 200 lb. per sq. in. and a maximum reduced pressure of 125 lb. per sq. in. In bronze, maximum initial pressure is 250 lb. per sq. in. with a maximum reduced pressure of 200 lb. per sq. in. They are available in six pipe sizes ranging from ⅜ in. to 1½ in.

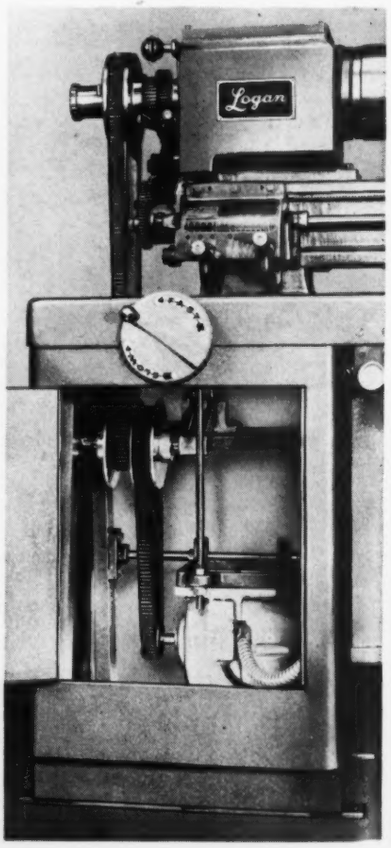
■

Colored Plastic Tape

This product, named Permacel 32 Plastic Colored Tape, is unaffected by solvents, acids, grease, oil, water or alkalies. It was developed by the Permacel Tape Corporation, New Brunswick, N. J., for severe service requirements of marking floor areas and overhead limits in plants and buildings.

The product, according to its manufacturer, gives a longer life than ordinary tape or paint. It comes in any desired width and in three colors red, white or yellow. Quick sticking qualities make it easy to apply directly from the roll.

■



Variable Speed Lathe

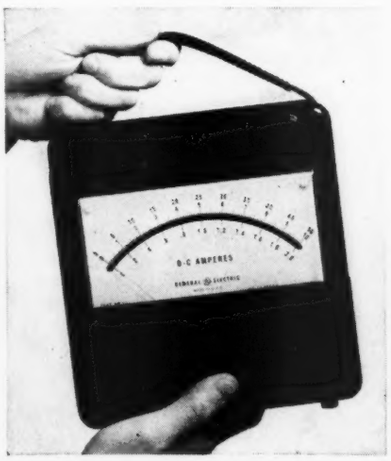
On models of its 12-in. lathe line, the Logan Engineering Company, Chicago 30, now offers a choice between the standard

double V-belt drive and a variable speed transmission.

The variable speed drive permits a wider spindle range than the V-belt drive, with an infinite choice of speeds between high and low. In back gear, the speed range is 38 to 295 rpm. In direct drive, the range is 250 to 1575 rpm.

Its large control handle makes speed adjustment simple. Twelve complete turns of this handle change the speed from lowest to highest rpm. The variable speed pulleys are piston-alloy aluminum. Power is transmitted by one 38 in. and one 60-in. belt.

■



Portable Electrical Instruments

Two series of improved portable electric instruments designed for maximum convenience and readability have been announced by the General Electric Company's Meter and Instrument Department.

The instruments, Type DP-11 and DP-12, shown in the illustration, are available to indicate volts, watts, amperes, and milliamperes.

The DP-11 was designed for general testing for electrical maintenance men who need a rugged, easily-read indicating instrument with an accuracy of ½ of one per cent of full scale.

The DP-12 is a high precision testing instrument designed for laboratory and field use. Accurate to ¼ of one per cent of full scale, this instrument is particularly suited to the maintenance of portable or switchboard instruments control panels, and numerous devices.

The instruments are encased in moulded Textolite having heavy ribbing and rounded corners to reduce breakage. Longer, easy-to-read scales, covered by unbreakable moulded windows permit increased readability in both of the new lines. The pointer scale is balanced on a thin knife-edge for optimum indicating accuracy.

The mechanisms of both instruments are similar in function and precision. Each contains a moving coil and a concentric magnetic structure with a soft iron core. Two Alnico magnets are die-cast inside a soft steel ring. The moving coil and

iron core are mounted in a separate die-cast frame fitting between the Alnico magnets. Each instrument measures 7¾ x 7⅞ x 3¼ in., and weighs 5 lb.

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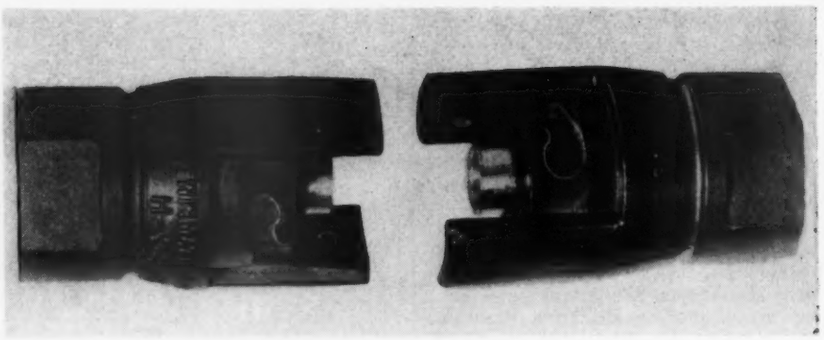
Air Pressure Shut-Off Valve

A two-way coupling for shut-off of air pressure when disconnecting air hose connections has been introduced by Twin-



matic Corporation, Los Angeles 64. The units have valves which automatically shut-off air pressure and eliminate the need to open and close air valves at the compressor tank.

Couplings are constructed with identical spring-seated valves in each end. Pressurized air bears against the valve ends, sealing them positively. Since both hose couplings are sealed, foreign particles are prevented from entering and traveling into the air tank.

Brass valves and seats are employed, and the coupling bodies are made of anodized aluminum. Under water tests at 125 lb. per sq. in. pressure show no leakage in either half of the coupling, or in the assembly.

■

Automatic Lubrication System

This lubricator is a flexible unit that is capable of delivering minute quantities of lubrication to as many as 36 individual points, regardless of the difference in pressures required. Called Lo-Flo Lubricator, it has a flow rate per feed ranging from 2.3 cu. in. per hr. to less than 1 cu. in. per 700 hr. It can pump a variety of lubricants from light oils to light grease at 60 deg. F.

Made by Nathan Manufacturing Corp., New York 29, it is available with a number of drives including rotary shaft, built-in ratchet, solenoid and pressure pulsation of liquids and gases in several gear ratios.

All outlets independently discharge the same amount of oil. With 500 lb. per sq.

in. working pressure and 1000 lb. per sq. in relief, there is sufficient pressure to overcome line blocks. The device stands less than 14 in. high and requires a minimum number of fittings.

■

Bushing and Bearing Extractor

This unit can be utilized for the extraction of bushings and bearings from any hole from ¼ in. to $^{25}/_{32}$ in. inside diameter. It was perfected by the Crozier Machine Tool Company, Hawthorne, Calif.

The series 100, as it has been designated, is available with a choice of single, two, four or ten expanding arbors to a set. Arbor sizes are ¼, $^{9}/_{32}$, $^{5}/_{16}$, $^{3}/_{8}$, $^{7}/_{16}$, ½, $^{9}/_{16}$, $^{5}/_{8}$, $^{11}/_{16}$ and ¾ in. The set eliminates the need for stocking many size pulls. Starter sets include steel carrying box, draw table, draw nut, antifriction washer and any two of the expanding arbors.

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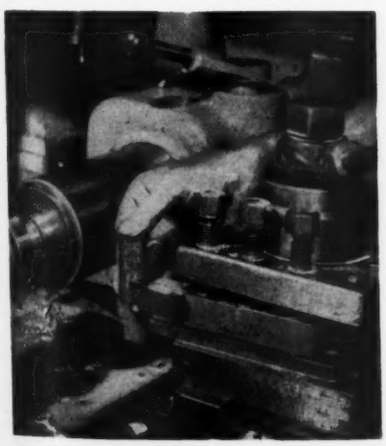

Silicon Carbide Hand Hone

Recently developed for on-machine sharpening of single-point tungsten carbide tools is a hand hone made available by the Chicago Wheel & Mfg. Company, Chicago.

The manufacturer states that up to 30 per cent longer "between grinds" tool life results when the hone is used. Machine operator applies a few light strokes over the tool edge, taking care to hold the hone flat against the surface. The device can be utilized with the tool mounted on its machine, cutting down time formerly needed for removal and regrinding.

Made from silicon carbide, it is bonded into a hard abrasive and is produced in many sizes for various sharpening operations.

Precision Rolled Tantalum Strip

Tantalum, a non-magnetic and corrosion resistant metal with tensile properties comparable to cold-rolled steel, is now available in strip form, rolled to close tolerances and thin gauges from the Industrial Division, American Silver Company, Inc., Flushing 54, N. Y.

The strip is custom rolled in widths up to 6 in. wide and down to 0.0005 in. in tolerances as close as plus or minus 0.0001

in. Typical uses in the railway industry include: heat exchangers and condenser parts, timing devices, signal and alarm systems, electronic controls, amplifiers and oscillators. The strip is available in any quantity from 1 lb. to several thousands of pounds.

■

Paint Stripper

Wyandotte Chemicals Corporation, Wlandotte, Mich., have introduced a new paint stripper, Wyandotte-21. Users report that this material completely strips 10 or more coats of paint from box cars in 6 to 9 min. for less than three dollars with utilization of proper equipment. It may be used in vats as a heavy-duty paint stripping compound, as a flow-on paint stripper and as a heavy-duty cleaner and paint stripper in steam guns. It is said to be effective on most types of paint, lacquer and enamel used by railroads. Compared to sand-blasting, savings up to 97 per cent have been recorded.

■

Profile Tracing Lathe Attachment

A simple profile attachment, said to be suited for short and long production runs of turnings such as boring operations, internal or external threadings, straight or taped facings, etc. has been marketed by Air Control Division of Lehigh Foundries, Inc., Easton, Pa.

Called the Pro-Tracer, the Model EL-1100 is designed for lathes handling up to 13 in. work. Installation or removal takes only a few minutes, and no alterations to the lathe are necessary.

Boring and inside diameter contours can be turned by the same method as conventional outside diameter turning, and a 90 deg. step can be cut in the direction of the feed. Turning 90 deg. shoulders in direction of feed, or blending a shoulder with a radius is possible on either inside diameter or outside diameter turning. Once setup, the unit can be operated by semi-skilled labor.